ELECTRICAL
REVIEW
Vol CXLVIII No. 3817 19TH JANUARY, 1951
THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872

Engineering and Engineers

LOOSELY APPLIED TERMS

IT has often been suggested that the description "engineer" ought to be restricted to men and women who have been educated to follow, as a profession, one of the branches of engineering. Craftsmen and industrial workers are called engineers, when it would be more accurate to call them fitters, erectors, plumbers, and the like. There is always a great deal of looseness in the use of descriptive terms. The name "doctor" means teacher; yet everyone who becomes qualified to practise as a physician is at once called Dr., although his qualification may be a bachelor's degree, or membership or licentiateship of one of the Royal Colleges.

Definition of Terms

It is always desirable to define the terms used in a discussion. The Oxford Dictionary defines the term "engineering" as "the work done by, or the profession of, an engineer," while the word "engineer" is given five definitions: (1) one who contrives, designs, or invents; (2) one who designs and constructs works, either military or (3) civil; then (4) a contriver or maker of engines (mechanical); and (5) one who manages an engine—in England a marine engine, in the United States a locomotive. One of the meanings of "engine" is mother wit, genius, ingenuity. Chaucer names "engin" as one of man's three sapiences, the others being memory and intellect.

Cultural Qualities

The first four definitions of an engineer indicate one who has received a high degree of specialized education and training. The engineer who becomes a member of the appropriate Institution must, in addition, conduct himself in a manner becoming the distinction he enjoys and the dignity of his chosen profession. His membership connotes a certain cultural background, with precision and accuracy in all that he does and considerable facility of expressing himself. The necessity for personal integrity is, of course, taken for granted.

It seems inevitable that there should be some cheapening of an honourable title. Just as the distinction "esquire" is used without discrimination, though the number of those legally entitled to it is very limited, so everyone who is engaged in a non-clerical occupation in the engineering industry is called an engineer by the newspapers, and so we read of "engineers" on strike, or demanding a general increase in wages of £1 a week. This diversion of the word from its true meaning makes it

necessary to find some other word to indicate the contriver, designer, or inventor, so we read of scientific workers, researchers, " atom men," " back-room boys."

The memorandum[1] issued in February, 1949, by the Institution of Electrical Engineers under the title " The Personnel of the Electrical Industry " states that " although it is not possible to list all the members of this personnel precisely, the following broad classes can be fairly clearly distinguished " and it proceeds to definitions of the terms professional electrical engineer, electrical technician, craftsman, and semi-skilled operative. It points out " the need for a considerable volume of educational provision for electrical technicians of a type which is at present so scarce as to be almost non-existent " and concludes by stating that the I.E.E. Council's Education and Training Committee has been requested to prepare a report and to make recommendations, concerning this deficiency.[2]

The definition of an electrical technician makes it clear that he is a well-educated and highly skilled technical assistant. There can be no reasonable objection to such persons being described as engineers, but it was not they who went on strike, or demanded a general increase in pay. The good honest word " worker " has been found in dubious company of late, but that is no reason why it should not be used in its proper sense, which would help to prevent the possibility of misunderstanding. Those who made the demand were engineering workers. Why not always call them so?

ARTIFICIAL LIGHTING

Illuminating engineering may be said to have begun when attention was paid to the effects of lamp light with the deliberate object of attempting to achieve a preconceived result. The pioneer in this respect was Benjamin Thompson, Count Rumford, whose treatise " On the Management of Light in Illumination "—a characteristic title—must be the first book on illuminating engineering ever published. It may thus fairly be claimed that the first illuminating engineer was an Englishman. To honour the memory of two other pioneers in this movement the Trotter-Paterson Memorial Lecture (which is referred to on another page) has been instituted and no more fitting choice of a first lecturer could have been made than the successor of one of them. Not only is the authoritative work on photometry of Dr. J. W. T. Walsh at the National Physical Laboratory recognized internationally, but he is the only member of the Illuminating Engineering Society who has twice been elected to the office of president.

MECHANICAL HANDLING

This term is being used so often just now that it was refreshing to have the subject of the A.S.E.E. lecture this week, to which further reference is made on another page, announced as " Electrical Machinery for the Movement of Materials." The choice was not fortuitous; it was intentionally made to place the emphasis upon the movement of materials rather than upon the driving motors and control gear. The latter very necessary adjuncts are so much superior to any other form of drive for practically all the machinery in question, that the lecturer had no cause to apologize for relegating electrical aspects to a secondary place in order to enable him more forcibly to direct attention to the opportunities there are for saving time and lowering production costs by bettering the way in which materials are handled than by interfering with the processing itself.

GENERATING CAPACITY

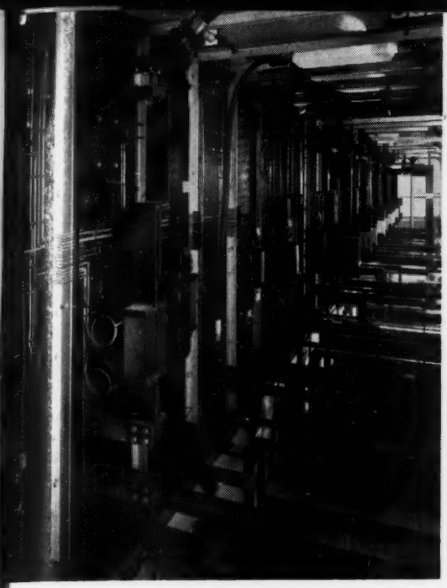
At a recent meeting of the N.W. Electricity Board's Consultative Council, the Board's chief engineer, Mr. O. Howarth, is reported to have said that the manufacturers of generating plant could not meet Divisional needs at the rate the B.E.A. would like. Surely it is the restriction imposed upon the B.E.A.'s plans by the Government's capital investment programme which is the obstruction rather than inadequacy of manufacturing resources for generating plant. The manufacturers claim that they are now in a position to provide 1,800 MW of plant a year and to build up in the near future to a figure of 2,000 MW, but the B.E.A. has said its programme for the next five years has been cut by the Government to orders for not more than 1,500 MW of new plant annually. Manufacturers, therefore, find themselves in the position of having to divert generating plant overseas which was originally intended to meet our essential home needs.

[1] " Men of the Industry," *Electrical Review*, 20th May, 1949, page 847.

[2] " The Men Between," *Electrical Review*, 10th November, 1950, pages 721 and 741.

Film Studio Supplies—II

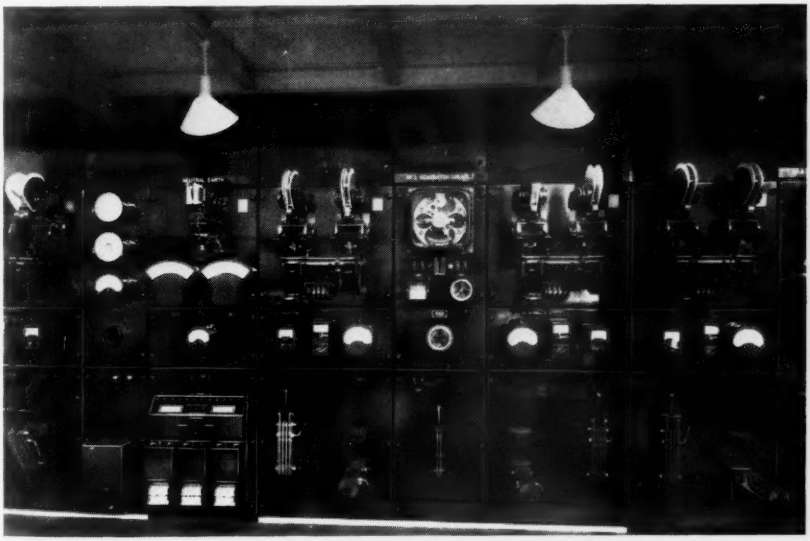
Distribution Arrangements at Shepperton

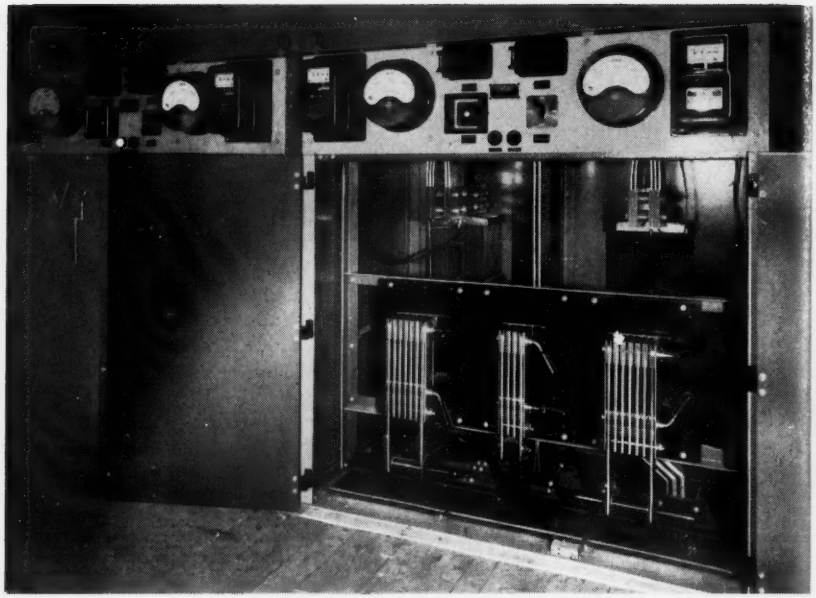


Rear view of power house feeder switchboard which is mounted on a gallery immediately above the generator board. The eight panels incorporated are variously rated from 1,000 A to 8,000 A per pole

IN last week's issue the arrangements for the combined public and private generation scheme at the British Lion Film Studios at Shepperton were described, and the present article deals with the distribution side of the installation. The main station busbars supply an eight-panel feeder switchboard mounted on a gallery immediately above the generator board and space has been left for future extensions. The present panels are variously rated from 1,000 A to 8,000 A per pole and are fitted with air circuit breakers, isolators, kWh meters and indicating and recording ammeters. Heavy aluminium busbars (6in by ½in section) are used for feeding supplies to the main stages

Section of the power house generator control switchboard which feeds the power house feeder switchboard seen above





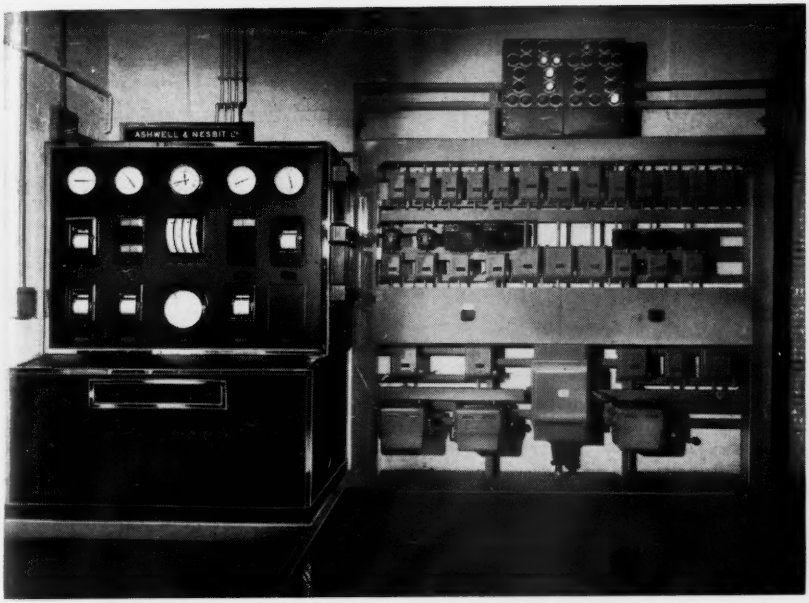
Main stage isolating cubicles

and by this means voltage drop at full load has been restricted to a total of 5 V of which 3 V is lost on the feeder and 2 V on the distribution inside the stage.

Each pair of stages is fed by two busbar feeders, the larger stage taking both and the smaller stage a loop from one of them. They are arranged in three-wire form with half section mid-wire and carry 6,000 A or 8,000 A per pole, the longest run being 870ft. The largest stage can thus take a maximum of 24,000 A of which its associated small stage can draw 16,000 A. The busbars, which are carried in a covered way, are of a standardized form of construction designed for studio application and finished matt black to increase heat dissipation. They are arranged in bar groups of 3/1/3, 4/2/4, 5/2/5 and 6/3/6. Expansion joints of foliated aluminium have been inserted at convenient points, particularly where changes of direction occur.

Section of the busbar distribution rings on one of the stages showing foliated aluminium expansion joints

Supplies are fed to the Scoring Stage and Effects Department via lead covered underground cables. During the course of the work a large "trick" stage was re-erected for which a supply capacity of 10,000 A was required some 1,000ft from the power house. This supply had to be made available within ten weeks from first instructions, which precluded any possibility of obtaining materials for busbars or constructing covered ways or tunnels. The supply was provided on the date required by employing over 10,000yd of ex-Government 0·5 sq in searchlight cable run bunched-parallel on impregnated cork separators in a shallow concrete trench and filled solid with a specially selected bitumen compound, the whole being covered with paving slabs.



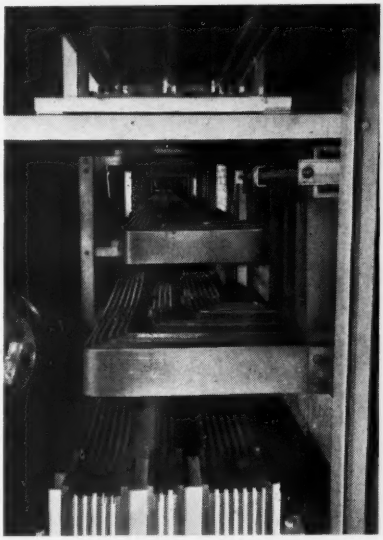
Main boiler house intake control and signal panel with instrument board for the four boilers alongside

Inside each stage the main isolating cubicles are interlocked both with each other and with the power house circuit breaker. Interlock switches fitted to the cubicle doors make it impossible for the isolators to be opened on load. Ammeters and kWh meters are provided, together with a stage control panel from which illuminated signals can be transmitted to and from the power house and which also carries controls for ventilation plants, house lighting, "shooting" and "rehearsal" signals, telephones, etc.

From the isolating cubicles aluminium busbar rings (3/1/3 carrying 3,000–4,000 A per pole) run on brackets on the roof trusses round the edges of the stage to a series of equally spaced high level distribution stations, eight (on one ring) for the smaller stages and ten (five on each ring, alternating) for the larger. At each distribution station solenoid operated circuit breakers (1,500 A per pole) control four distribution panels provided with knife switches, 300 A cartridge fuses on each pole and take-off bars of the studio type.

When a supply is required on the stage a signal (by rotary switch) from the stage control panel is transmitted to an indicator

Main aluminium busbar feeders to stages



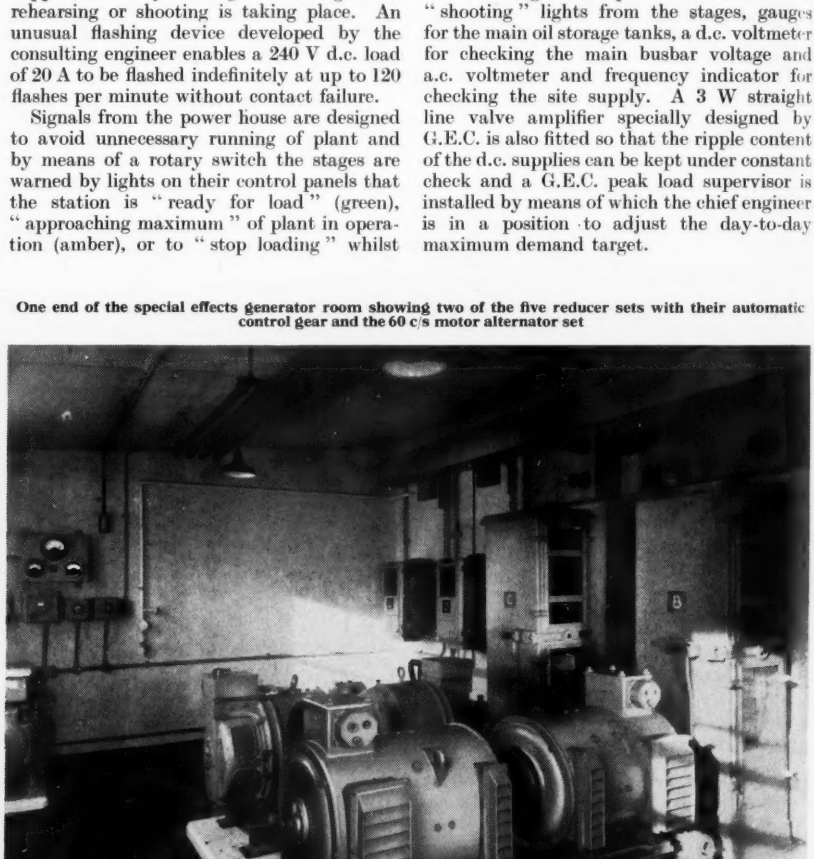
panel in the power house requesting the operation of the appropriate circuit breaker which in turn cancels the signal and energizes the no-volt circuits of the local distribution stations. Further rotation of the switch gives another signal indicating that the supply is no longer required. Other positions of the switch warn the power house that the stage intends to load up or shed or is in process of "shooting."

Flashing and steady red lights placed at strategic points around each stage and supplemented by bells give warning when rehearsing or shooting is taking place. An unusual flashing device developed by the consulting engineer enables a 240 V d.c. load of 20 A to be flashed indefinitely at up to 120 flashes per minute without contact failure.

Signals from the power house are designed to avoid unnecessary running of plant and by means of a rotary switch the stages are warned by lights on their control panels that the station is "ready for load" (green), "approaching maximum" of plant in operation (amber), or to "stop loading" whilst another machine is brought in (red). In certain cases it has been found uneconomic to transmit these various signals by direct multi-core connections. Instead, a balanced bridge system has been employed which, operating motor driven switches through moving coil relays, enables eight different signals to be transmitted in either direction over three wires.

A further indicator panel has been installed in the chief engineer's office in the administration building. This panel carries a set of "shooting" lights from the stages, gauges for the main oil storage tanks, a d.c. voltmeter for checking the main busbar voltage and a.c. voltmeter and frequency indicator for checking the site supply. A 3 W straight line valve amplifier specially designed by G.E.C. is also fitted so that the ripple content of the d.c. supplies can be kept under constant check and a G.E.C. peak load supervisor is installed by means of which the chief engineer is in a position to adjust the day-to-day maximum demand target.

One end of the special effects generator room showing two of the five reducer sets with their automatic control gear and the 60 c/s motor alternator set



For sound recording purposes a 230 V, 3-phase, 3-wire a.c. supply is required. A special substation has been constructed and the supply is normally obtained from a 50 kVA London Transformer Products oil-immersed transformer. An alternative supply is provided by a d.c. driven Lancashire Dynamo & Crypto 12 kVA motor-alternator set which will ultimately be thermionically stabilized for voltage and frequency. Supplies are fed to the stages through an open front knife switch and fuse distribution panel.

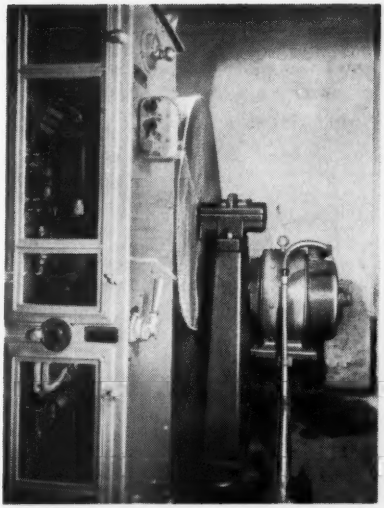
Controlled-Voltage D.C.

The special effects stage requires a number of controlled-voltage d.c. supplies which can be independently adjusted at will over a range of 90–130 V, in addition to the supply taken direct from the power house. Five motor-generator sets arranged as reducer sets with an input of 240 V and a nominal output of 120 V have been installed in an adjacent generator room. The sets range from 300 A to 45 A in capacity and each is provided with an Isenthal automatic voltage regulator and Brookhirst automatic control gear both remotely operated from control panels in the stage. A 5 kW motor-alternator set provides 230 V, 3-phase at 60 c/s and a 4 kW single-phase oil-immersed transformer provides 110 V, 50 c/s. Provision is also made for a remotely operated selsyn interlocking system.

The main stage plenum and exhaust ventilating plants which embody 20 h.p. main fan motors are controlled through Brookhirst automatic switchgear by means of push-buttons on the stage control panels. Provision is made for two-speed operation, the lower speed being adjustable so that the plant can be set to run during shooting at the highest speed which the particular production can tolerate in relation to noise and air movement. Signal lamps show which speed is being used.

The work included the re-design of electrical installations in all existing buildings in addition to new construction and altogether about fifty stages, workshops, restaurants, crowd blocks, and other buildings including a large hotel, have been re-electrified.

The architect responsible for the design of the power house was Mr. A. C. Tripe, F.R.I.B.A., assisted by Mr. O. Garry, A.R.I.B.A. The electrical and power house consulting engineer was Mr. C. B. Faulconbridge, A.M.I.E.E., M.B.K.S. The chief engineer to the studios is Mr. Chas. W. Hillyer. The main power house contractors were the General Electric Co., Ltd., the main electrical contractors on the site being Troughton & Young, Ltd.



One of the 20 h.p. motors with automatic control driving a ventilation plant in one of the stages

Activities for the E.I.B.A.

TO help the Electrical Industries Benevolent Association the Electrical Wholesalers' Federation organized a comprehensive collection scheme in 1938. In 1950 the collection amounted to £2,229, which compares with £2,000 collected in 1949. This has been a significant help to E.I.B.A. in addition to the value of the money itself, because the less the Association has to extend itself in the collection of funds the more it can concentrate on solving the many, and often bewildering, problems of its beneficiaries. Mr. H. J. Grant, who has "fathered" the scheme since Mr. W. C. Yuille was forced by ill-health to hand it over, is to be congratulated on the results of his first year's work, as are all his collectors.

On the contracting side of the industry, Mr. J. G. Craven, M.I.E.E., of Green & Smith Ltd., Leeds, has just been successful in collecting from his E.C.A. colleagues in the West Yorkshire Branch Area subscriptions totalling £100.

For the manufacturers, Mr. D. G. E. Barrie of Metway Electrical Industries, Ltd., has, for the second year running, topped the £100 mark in his appeal to electrical and non-electrical companies with whom he has close contacts.

Economical Loading

Diagrammatic Method for Individual Stations and Whole System

By N. DON

SOME time ago in the *Electrical Review* economical loading of plant was dealt with in a most comprehensive manner.* The author pointed out that the subject is full of difficulties for the control engineer if handled by arithmetic, in that it rests on the working out of various combinations of loading of machines in order to find the most economical spreadover of load.

As combinations of machine loadings on a present-day system can run into large numbers, any attempt to deal with the matter by calculation becomes unwieldy as the calculations would have to be repeated many times during every 24 hours due to change of load, change of plant and still further changes governed by import and export limiting factors. A large amount of these calculations can be dispensed with if the subject is treated diagrammatically, thereby presenting to the station staffs a form of ready reckoner suitable for hour-to-hour change of conditions and not entailing long calculations in the present article. The method proposed does not claim to take care of all the factors which go to make up the cost of a unit, as it is based on the efficiency of the turbines, but there does not appear to be any reason why the basis should not be the all-in cost rather than only that part of the charges which relates to plant efficiency.

The method has been split into two parts, the first dealing with the economical loading of individual stations, and the second with a whole system. Scheme 1, built up in the form of a nomogram (Fig. 1) is straightforward, but Scheme 2, especially where the number of machines is great, can become a trifle unwieldy, but even so should serve the control engineer well, and in use would tend to become simpler.

Scheme 1

This arrangement readily answers the question of whether to run two machines or three for certain loads, and also whether to shut down some machines during the midday drop in load.

In Table 1 the consumption of steam in lb/kWh of three machines A, B and C is set out at various loads. In Table 2 these figures are converted into thousands of lb/hr in order to get steam figures which are progressively greater with increasing loads with which to set out the nomogram.

The nomogram is laid out by using the

* Economic Loading of Generating Plant, by G. Oldroyd, *Electrical Review*, 9th December, 1949.

Fig. 1.—Nomogram

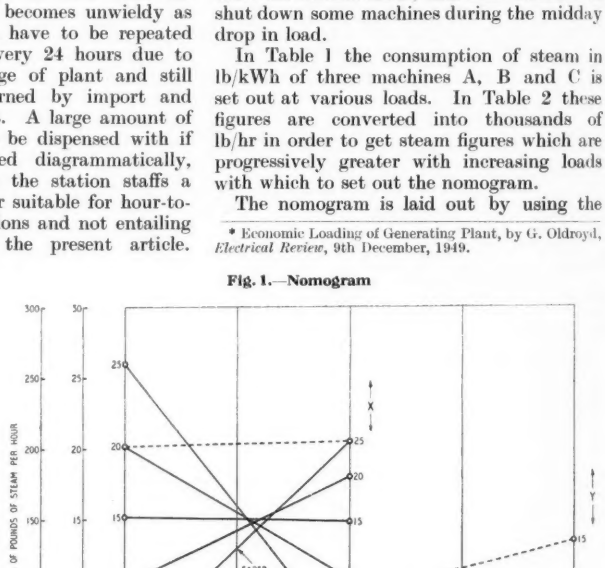


Table 1.—Steam Consumption, lb/kWh

Machine	5	10	15	20	25 MW
A	10·9	10·4	10·2	10·1	10·4
B	11·7	10·8	9·9	9·0	8·2
C	10·0	9·5	9·0		

Table 2.—Thousands of lb/hr

Machine	5	10	15	20	25 MW
A	54·5	104	153	202	260
B	58·5	108	148·5	180	205
C	50	95	135		

figures in Table 2 but the points set down for these figures are designated as MW because the engineer is concerned with MW only in all his loading calculations. This cuts out all need for dealing with steam consumption after his initial calculations for Table 2.

The nomogram should be on squared paper to simplify setting down and also, when completed, reading results. The height should be as great as possible so that differences between characteristics of several machines will be readily appreciated. The extreme left-hand vertical line of the squared paper should be calibrated in thousands of lb/hr and used merely as a reference line, from which the nomogram itself is offset. The values in the body of Table 2 are set down on their respective lines, starting from the base line upwards, and marked in MW.

The method of operation is as follows, taking for example 30 MW divided between machines A and B. The possible combinations are 5 MW on A plus 25 MW on B, etc., in short 5A 25B, 10A 20B, 15A 15B, 20A 10B, 25A 5B. It is the work of a moment to join these points on lines A and B, and without any calculations the lowest consumption is seen to be 5A 25B as represented where their joining line intersects line A+B. Should lb/hr be required the figure is read off the datum line and multiplied by 2. Similar combinations between B and C are read off line B+C, and between A and C off line A+C (which is incidentally line B).

For three machines the procedure is slightly different. The first step is to find the *largest* amount of *most* economical load. From Table 1 this is obviously 25 MW at 8·2 lb/kWh, or if another datum line be added representing an imaginary machine with a steam consumption of 10 lb/kWh (or other suitable figure) throughout its range, the most economical point can be judged by its distance below this second datum line values as shown at X and Y. Further to illustrate this point as to the largest amount of most economical load, let us assume that the values (Table 1) 8·2 and 9·0 for machine B along with 9·0 for machine C had been 10 in all cases. Then the largest amount of most economical load would have been 9·5 for machine C.

With a load of 55 MW the most economical loading for three machines will now be considered. First, referring to Table 1 or the nomogram, the largest amount of most economical load is 25 MW on machine B leaving a balance of 30 MW to be shared by machines A and C. This amount of load is computed on the nomogram as for the example for A and B. The load sharing is then 25 MW on B and the remainder as found from the nomogram.

Following the above, comes the case of whether it is more economical to run two machines or three for a given load. Let us consider 45 MW. As above, the largest amount of most economical load is selected—in this case 25 MW on machine B—leaving 20 MW for examination. If two machines are run, it must be B and A to cover 45 MW. From the nomogram the answer is 203·5×2=407. If three machines are run, the most economical combination for machines A and C is 15C 5A for 20 MW. This figure is 94·75×2=189·5 which when added to 205 for 25B makes a total of 394·5. Obviously it is a saving to run three machines rather than two.

Points A′B′C′ are the consumption values for the three machines at no load. From these points it can quickly be worked out whether it is advisable to take one machine off load during the midday drop in load and keep it running light, or continue to have it generating. A further set of points could be set off for the amount of steam used to run up the various machines and from this could be gauged the advisability of shutting down one unit, running it light or keeping it on load during the midday period of light load.

To handle four machines on the nomogram presents slightly more work, but it soon becomes evident that the least efficient machine must be the last to be considered. Perhaps the quickest method would be to select the largest amount of most economical load, and then dismiss this in subsequent calculations—i.e., treat the remaining amount of load as a three-machine question. The loading would then be the largest amount of most economical load plus the remainder spread over the three remaining machines.

Any attempt to carry the nomogram above four machines is not advisable, as to find the most economical combinations of five machines would take too long and defeat the object of the nomogram method; this statement in view of what follows appears to be a paradox, but examination will prove otherwise.

Scheme 2

This has been devised to handle a system consisting of a number of stations and is therefore at first sight an attempt to find the most economical running for the total number of machines on the system—in short, to find the best figure for a number of machines exceeding four, which under Scheme 1 was inadvisable. A closer view of the subject reveals that the system is a number of separate units built up to form the whole—each unit being a station. Each must be regarded as such because, except at times of light load, it must run by virtue of its local load, local load being a supply to a town or contribution to a part of the area of the whole system; it is therefore indispensable, even though less economical, to run than other units on the system. It is this compulsory allocation of load which splits the system into units.

Although the second scheme is akin to the first the layout is different so as to cover all the machines on the system on one diagram. Tables 3 and 4 are similar to numbers 1 and 2.

For Table 4 translate the steam consumption figures into B.Th.U./kWh as a common basis for comparison between stations. Total cost per unit might also be used as a basis of comparison and a still more accurate overall figure obtained. However, for simplicity in illustration, the former figure has been used. Taking a round figure of 1,400 B.Th.U./lb steam, Table 4 will be as under in 10^7 B.Th.U./kWh.

Figure 2 is built up as follows:—U is the base line and lines VWXYZ are each 140 units of distance ahead of each other and of the base line. These lines are for reference only and represent the 10^7 B.Th.U./kWh of a machine taking 10lb steam (at 1,400 B.Th.U./lb per kWh) at all loads. The figures in Table 4 are set down opposite their respective machines and a line drawn to these points from the reference lines. The slope of these lines shows at a glance the relative consumption of all machines at all loads.

The most efficient base-load station would be represented by ABCD, ABCD being four machines. Below and bracketed would be the other stations, either in order of efficiency or in order of compulsory running, that is, the stations most in use would head the list.

Table 3.—Steam Consumption, lb/kWh

Machine	10	20	30	40	50 MW
A	10·9	10·4	10·2	10·1	10·8
B	11·7	10·8	9·9	9·0	8·2
C	10	9·5	9·0	9·5	9·8
D	13·1	13·1	13·1	13·1	13·1

Table 4.—10^7 B.Th.U./kWh

Machine	10	20	30	40	50 MW
A	152·6	291·2	428·4	565·6	756
B	163·8	302·4	415·8	504	574
C	140	266	378	532	686
D	183·4	366·8	550·2	733·6	917

Against each unit would be the amount of plant available in that unit and also the amounts of import and export in addition to the value of the link capable of transferring load. The amount of local load could be set down opposite to the foregoing figures. Figure 3 shows how the foregoing could be set out with typical load conditions, along with demands at various times attached to unit 2. The latter figures are necessary to take the place of 90, 150, and 80 which are instantaneous values. Figure 3 is the complete build-up from Figure 2.

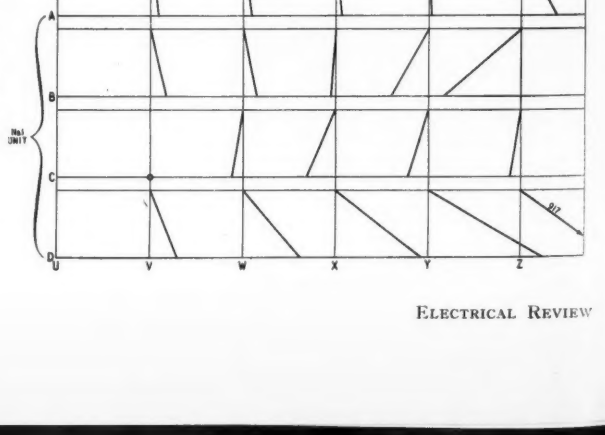


Fig. 2. — Consumption figures for individual machines in all stations of a system

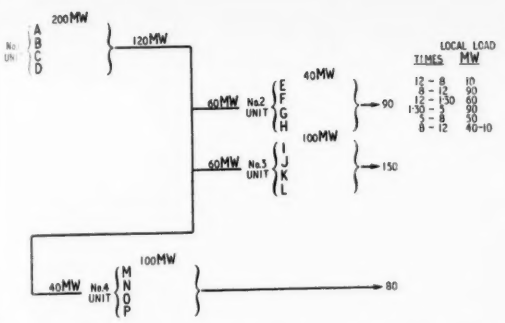


Fig. 3.—**Schematic diagram of all plant, tie lines and load distribution of a system**

Station 1 having no local load, its whole output is available for export. Stations 2 and 3 will not cope with all their load while number 4 is in a position to export a certain amount.

The above figures might well be characteristic instantaneous simultaneous loadings. From unit 1 120 MW is available. Topping the list as it does, it is obviously the most efficient and therefore all this amount must be exported—this is independent of the absence of local load. Units 2 and 3 are left with no option but to import a minimum of 50 MW each, leaving 20 MW to spare from unit No. 1 and 20 MW from unit No. 4.

Analogy will most readily illustrate the use of Figure 3. The speed of a wartime shipping convoy is the speed of the slowest ship. The adding of ships with higher and higher speeds would not bring up the speed of the whole; it would only add to its total carrying capacity whereas *replacing* the slowest ships *would* raise the convoy speed. Thus in Figure 3, the 120 MW must be used to replace the largest *possible* amount of *least* economical load—in this case 40 MW of unit 4. It may be that 60 MW of unit 4 requires replacing but it is *possible* to replace only 40 MW. This leaves 80 MW to be dealt with and a maximum possible inlet each to units 2 and 3 of 60 MW. The procedure here would be the same as for unit 4, viz., to cover the largest possible amount of least economical load. Using Figure 2 as representative of one of either units 2 or 3, the amount to be removed would be 50D and 10A, provided the economic values of these pieces of load are below those of the other unit.

The all-over economy on an all-in cost per kWh basis cannot be arrived at graphically by Figure 2 because part of the all-in figure is not additive. Salaries, wages, cost of offices do not vary with change of load. The cost of station buildings does, but not in direct ratio to the plant brought in to handle, varying load, in fact these figures almost tend to vary inversely with load variation, while direct generation costs such as coal, ash and water all increase with rising load.

Although this article does not deal so fully with the subject as that of Mr. Oldroyd, it has attempted to put the subject into a form readily workable by the control engineer and therefore should be a step in the right direction. Further study might uncover a means whereby the subject could be dealt with by using the total cost of generation of a kilowatt-hour.

Electric Tower Clocks

ONE of two automatically-wound tower clocks recently made by a Nottingham firm has been installed in Durham Castle, where it replaces a very ancient mechanism. It has an invar pendulum, gravity escapement, very compact automatic winding mechanism, ball bearings, totally enclosed motion and bevel works, and other details that will improve reliability and timekeeping. The original dial has been reconditioned and the clock has been arranged to strike the hours.

The other clock, with similar mechanism, is now at work in the tower of the church of St. Stythians, Cornwall. This tower is over 500 years old and is said by some to be the finest of its kind; so great care had to be taken to design every detail in keeping. Four 4ft 6in skeleton dials have been mounted directly on the granite walls of the tower and finished in gold leaf; the original architectural effect remains unspoiled.

The fact that this rather remote village church clock is automatically-wound shows how rural electricity has added one more advantage to country life, especially as it seems increasingly difficult to have the older type of weight-driven clock wound at the proper intervals. Both these clocks were constructed and installed by G. & F. Cope & Co., Lenton Nottingham.

Recovery of Premises

Appealing Against a Possession Order

By F. E. SUGDEN, A.C.I.S., Barrister-at-Law

IN my last article (*Electrical Review*, 3rd November, p. 698) I dealt with the subject of the recovery of possession of a house-shop by a landlord. I pointed out that when the landlord has to offer alternative accommodation, it is not necessary for him to make provision in this respect for the shop portion of the premises, but for the living accommodation only. But the County Court Judge will also take into consideration any financial hardship, for example, loss of goodwill, which the tenant may suffer if he is turned out of his premises. I also explained that, if the tenant was aggrieved because of this threatened loss, he could appeal against the County Court decision.

Grounds for New Trial

Where a tenant is dissatisfied with the decision of the County Court Registrar or Judge he may appeal against it or apply for a new trial. I should explain that some cases can be tried by the Registrar with the consent of the landlord and the tenant. Without this consent the Judge must try the case. If the tenant is aggrieved by the Registrar's decision, then he can apply for a new trial to the Judge in the same court.

Generally speaking, where it is alleged that the original decision by a Judge was wrong in law, an appeal lies to the Court of Appeal, but where no judicial error is alleged then the proper remedy is to apply for a new trial. For example, a tenant may not have had proper notice of the proceedings or was unprepared with his evidence or has discovered new evidence; or evidence given at the trial was inadvertently not taken into account.

In the case of new evidence the tenant should apply to the County Court Judge who tried the case in the first instance, for leave for a new trial in the same Court and, if necessary, before the same Judge. If the Judge refuses to grant a new trial, then the tenant must go to the Court of Appeal.

On the other hand, suppose the evidence was available but unfortunately his legal adviser did not put it forward at the trial, then again the tenant should apply to the County Court Judge for a new trial. He will then have to show, by the new evidence, that if the judgment given against him is allowed to stand he is likely to suffer substantial injustice.

As I have said, a landlord seeking recovery is compelled only to house the tenant and he can ignore the business carried on in the shop portion of the premises. Nevertheless it is laid down that an order for possession shall not be made by the Judge until he has ascertained the respective degree of hardship which will be suffered by the two parties. The financial loss, including loss of goodwill, which the tenant would suffer if he were turned out of his shop should be taken into consideration by the County Court Judge. If he does not do so, then the tenant should apply to the Judge for a new trial, and if this is refused he should, in turn, apply to the Court of Appeal.

The order for possession made against the tenant may require him to leave the premises before the new trial or the hearing of the appeal. In these circumstances he should immediately file an application at the County Court for a stay of proceedings pending the hearing of the appeal.

I would stress that an appeal against a judgment must be based on a claim that the decision of the Judge was wrong in law. That is why, in normal cases, it is advisable to apply for a new trial, if some evidence in the tenant's favour has been omitted or neglected. The time factor is all-important and if an appeal is to be lodged the aggrieved tenant must act promptly; otherwise his legal rights will be lost for ever.

Brazilian Imports

DURING the first nine months of 1950 Brazil imported from Great Britain electrical goods and apparatus to the value of £1,120,865: boilers and boiler house plant, £175,856; electric motors and parts, £89,810; other electrical machinery, £163,057.

Impulse Generators

Summary of the I.E.E. Discussion

THE need for high voltage generators that will produce the standard voltage wave-shapes specified for the impulse testing of electrical apparatus, for which there is an increasing demand, was explained in a paper submitted by Messrs. F. S. Edwards, F. R. Perry (Metropolitan-Vickers Electrical Co., Ltd.) and A. S. Husbands (Royal Technical College, Glasgow) to the Institution of Electrical Engineers.

Following an analysis of the generator and load circuit, the development and design of a generator for high voltages was described. The method of multi-stage operation was reviewed and illustrated with oscillograms of two typical generators. Some of the auxiliary equipment needed was mentioned and the paper concluded with an example of impulse testing procedure.

Discussion

Mr. R. Davies (N.P.L.) opened the discussion with the remark that buyers of electrical equipment were becoming very surge-conscious and many transformer manufacturers were having to install surge generator equipment. Generators of about 1,000 kV should cover 90 per cent of their work, but he felt that the time had come to consider whether there should not be somewhere in this country, possibly at the N.P.L., a high-voltage surge generator capable of dealing with the exceptional cases.

Dr. L. G. Brazier (B.I. Callender's Cables) said that since 1923 all the developments had been in elaboration of the Marx circuit, but a single-stage capacitor charged to a high voltage should make a very fine surge generator. In 1923 there were no good methods of producing rectified high-voltage d.c., but since then enormous developments had taken place. In cable testing, he believed it to be physically impossible to produce the waveform called for by the B.S. specification, which should be amended.

Dr. K. Konstantinowsky, in a communication read in his absence by Mr. J. K. Webb, stated that the impulse testing of cables and accessories was assuming an importance at least equal to that of the 50-c/s high voltage routine test and it was therefore important to inquire whether the practice of carrying out such a test on a few yards only of cable was valid. Most of the world's impulse generators did not appear capable of testing lengths of more than 30 yards, but there were generators available in Switzerland, Germany and Denmark, for example, which could test complete manufacturing lengths. They differed fundamentally from the designs mentioned by the authors in that a high-voltage cable was used as the generator capacitance, and so much higher charging voltages could be used. Selenium rectifiers could be employed; his firm had already made such a rectifier of 400 kV and was confident that it could design one for 1,000 kV. With this system, all the complications of the Marx switching arrangements could be cut out, capacitance efficiency was improved and the floor space occupied was surprisingly small; and it was possible to be assured that every bit of cable which went into service had been tested.

Mr. J. L. Robinson (Ferranti), referring to the initiation of the discharge of the impulse generator, said that in most cases the moment of initiation was under control, and the great disadvantage of provision for uncontrolled operation was the provision of a delaying cable between the potentiometer and oscillograph, which was a severe drawback with the capacitance potentiometer in particular.

Cable-Drum Generator

Mr. D. F. Oakshott (B.E.A.) mentioned the so-called cable-drum generator, wherein the capacitors were formed of drummed-up high-voltage cable. He had once been responsible for the construction of one of these bulky devices. It had the advantage of firing through very readily, the stray capacity to earth of each condenser being high. A drum 8 or 9 ft in diameter and about 2 ft deep might have a self-capacitance

of the order of 200 $\mu\mu$F, which was very much more than that of a conventional generator.

Mr. E. T. Norris (Ferranti) said the paper was a very good description of the state of the science, but not so complete a description of the state of the art. The testing of cables with high-voltage continuous d.c. would probably increase and there should be scope for the combination of the two types of apparatus, which might seriously influence the design of surge generator circuits so far as the Marx principle was concerned. In the practical construction of surge generators different characteristics were required depending on the class of apparatus being tested. Switchgear and line insulators were of comparatively low capacity as a load, and the inductance was not troublesome, while for cables, where the load capacity was very large, it might be one of the limitations.

Impulse Testing

Mr. H. M. Lacey (E.R.A.) emphasised the importance in an acceptance test of avoiding damage to the apparatus being tested; in ascertaining what sort of life it would have, one must not shorten that life. In the early days of impulse testing many people wondered whether the test was doing any damage. That difficulty was being rapidly overcome, and he thought that in time the impulse test for certain apparatus would entirely supersede the 50-c/s test. It might be possible to go further. Any over-voltage test imposed some risk; means might be devised for determining the probable life of apparatus without appreciably exceeding its normal voltage. He had in mind the method known as measuring the initial discharge voltage, which could already be applied to certain types of apparatus and might be adapted to others.

In connection with the initiation of generator discharges, a method which had many advantages was of the 3-electrode type, where the main gap was between discs with rounded edges and the auxiliary electrode was introduced through a hole in the centre of one of those electrodes and consisted of a thin rod.

Mr. T. R. P. Harrison (W. T. Henley's) from the point of view of cable testing, said that it was rarely possible to get the 1/50 microsec wave demanded by B.S. 923. For four or five years they had been asking for the amendment of that specification, and he hoped they would eventually obtain it.

Mr. F. W. Taylor said that when it was decided to include the wavetail control resistance and part of the wavefront control resistance within the confines of the generator, a wire-wound type was developed which was very simple and had proved satisfactory. It could be designed to meet any desired arrangement of condensers and any desired value of resistance, heat capacity or length, simply by changing the size of conductor, and with suitable end-caps flashover values of well over 10 kV/in could be obtained. When employed in a 1,200-kV generator of 0·025 μF total capacity on a cable load of 2,500 picofarads, a wavefront of 1·0 microsec at 1,000 kV was easily obtained, indicating that the inductance was small enough.

Mr. W. G. Hawley said that the column type of generator saved floor-space, but something should be done to save height, because it was the height of buildings that caused trouble. He had figures relating to a number of generators in different parts of the world which, if brought down to a basis of 1,000,000 kV, ranged from 8½ ft per 1,000 kV for a Swedish generator up to 13 ft per 1,000 kV.

Mr. H. Boldingh, Dr. P. Hammarlund and Mr. A. C. Sim also took part in the discussion, to which Mr. F. S. Edwards replied.

Electricity in Gas Showrooms

AN electrical installation is to be provided in the central Manchester gas showrooms at a cost of £1,795, which will be recoverable from the North Western Gas Board. The Town Hall Committee reports that the existing gas lighting installation in the gas showrooms and demonstration theatre does not provide an adequate intensity of lighting for showroom purposes: there are no facilities for connecting working models for demonstration purposes in the windows and no provision for interior lighting of showcases and small demonstration pieces. In addition, the gas fittings in the basement showroom and theatre generate too much heat, thus making the atmosphere foul and uncomfortable.

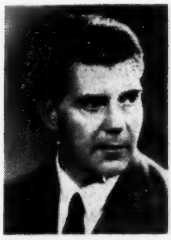
It is proposed to disconnect and remove the existing gas lighting installation in the gas showrooms and theatre and to install electric lighting, utilizing as many as possible of the existing gas fittings.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Council of the Institution of Electrical Engineers at its meeting on 11th January, elected **Mr. P. V. Hunter**, C.B.E., past president, to honorary membership of the Institution for his outstanding services to the electrical industry and to the Institution. The Council of the Institution has also made the 29th award of the Faraday Medal to **Mr. T. L. Eckersley**, B.A., B.Sc., Ph.D., F.R.S.,

Mr. P. V. Hunter



Dr. T. L. Eckersley

for his achievements in the field of radio research and, in particular, for his outstanding contributions to the theory and practice of radio-wave propagation.

Mr. Hunter was educated at Wisbech Grammar School and received his technical training at Faraday House and with the firm of Willans and Robinson. Practical experience was obtained in the Great Yarmouth and the Willesden supply undertakings, and for a time with Robert Hammond. In 1904 he joined Merz and McLellan, consulting engineers, and was head of the electrical department until his appointment in 1919, as joint manager and chief engineer of Callender's Cable & Construction Co., Ltd., of which he became a director in 1937. He is now deputy chairman of B.I. Callender's Cables, Ltd., and chairman of B.I. Callender's Construction Co., Ltd. Mr. Hunter has for many years been chairman of the National Register of Electrical Installation Contractors, and has represented the Institution on several committees of the British Standards Institution, the British Electrical and Allied Industries Research Association, the British National Committee of the International Electrotechnical Commission, the Council for Codes of Practice for Buildings, and other important organizations. He is a Fellow of the American Institute of Electrical Engineers. During the 1914-1918 war he was Engineer-Director to the Experiments and Research Section of the Anti-Submarine Division of the Naval Staff. His invention early in the last war of the buoyant cable contributed largely to the defeat of the magnetic mine. Mr. Hunter has done work of outstanding value on numerous Institution committees, and for a number of years has been chairman of the Committees on Regulations for the Electrical Equipment of Aircraft and of Buildings, and of the Committee on Model Forms of General Conditions of Contract.

Dr. Eckersley was educated at Bedales School, University College, London, and Trinity College, Cambridge. He joined the National Physical Laboratory in 1910, and in 1913 and 1914 took part in the Egyptian Government Survey. During the 1914-18 war he served with the Royal Engineers in Egypt and Salonika on wireless intelligence and on the cessation of hostilities joined Marconi's Wireless Telegraph Co., Ltd. His work with that company has been chiefly concerned with radio-wave propagation, a field in which he has won a world-wide reputation which was acknowledged in 1938 when he was elected a Fellow of the Royal Society. During the last war he was seconded to the Air Ministry. Dr. Eckersley has presented many papers before the Institution and has been awarded many Premiums, including the Duddell Premium (four times, in 1922, 1927, 1929 and 1932) and the Kelvin Premium (1940).

Mr. R. L. Chantrill, B.Sc., M.I.E.E., Mem.A.I.E.E., chief technical engineer of the British Thomson-Houston Export Co., Ltd., since July, 1949, has been elected a director of the company. After early education at St. Paul's School, London, Mr. Chantrill served an articled apprenticeship with Vickers, Ltd., and subsequently gained further engineering experience in that company's Oil Engineering Department. In August, 1924, he joined the B.T.H. Switchgear Engineering Department.

Mr. R. L. Chantrill

and from August, 1929, until May, 1932, he was on loan by the B.T.H. to the Government of the Punjab. During the following years, until July, 1949, he was on the engineering staff of A.E.I. (India), Ltd., excepting for a six months' period in 1935 when he served the Hydro-Electric Department of the Government of the North West Frontier Province as technical adviser on the design of the Malakand hydro-electric project. In November, 1942, he was appointed chief engineer and elected director of A.E.I. (India), Ltd., in charge of the Engineering Department. Since his appointment as chief technical engineer of the British Thomson-Houston Export Co., Ltd. Mr. Chantrill has toured Norway, Sweden, Finland, Australia, New Zealand, Canada and the United States.

Following the retirement on 31st December of **Mr. J. G. Lowe**, F.C.W.A., comptroller and secretary of the Metropolitan-Vickers Electrical Co., Ltd., **Mr. E. Salmon** has been appointed comptroller and **Mr. D. Thomson** secretary as from 1st January. **Mr. W. D. Taylor** has been appointed to succeed Mr. Lowe as secretary of the Metropolitan-Vickers Electrical Export Co., Ltd.

Mr. Lowe has been in the company's service for over forty-five years, joining the Westinghouse Electric & Manufacturing Co., as it was then known. He became assistant secretary in 1920, treasurer in 1925, and assistant comptroller in 1928. In 1937 he was appointed comptroller in succession to Mr. E. H. V. Cooke. On the retirement of Mr. R. H. Haviland in 1946, Mr. Lowe became secretary, both of the Metropolitan-Vickers Electrical Co., Ltd., and of the Metropolitan-Vickers Electrical Export Co., Ltd.

Mr. Salmon joined the British Westinghouse Company in 1915. After holding senior positions in the accounting and secretarial departments he was appointed assistant accountant in 1926, accountant in 1937 and chief accountant in 1946.

Mr. Thomson joined the company's Accounting Department early in 1918, following service with H.M. Forces. He was appointed chief clerk in 1937, internal auditor in 1942 and assistant secretary in 1946. He is a Fellow of the Chartered Institute of Secretaries.

Mr. Taylor joined the company's London office in January, 1916, being appointed London cashier in 1935. From 1924 to 1946 he also assisted the late Mr. R. H. Haviland, secretary of the company, and last year he was appointed secretary of Metropolitan-Vickers (GRS), Ltd.

Mr. E. Tankard becomes chief accountant of the company and **Mr. A. Cooper** assistant accountant as from 1st January. Mr. Tankard joined the company in April, 1913, and became assistant accountant in 1942. For a period during 1930-32 he was transferred to Uruguay, where he acted as the company's site accountant on the Montevideo power station contract.

Mr. Cooper joined the Accounting Department in 1937, and became internal auditor in 1946. He is a B.A.(Com.) of Manchester University, an Associate of the Institute of Cost and Works Accountants, and an Associate of the Chartered Institute of Secretaries.

Mr. F. V. Brook, vice-chairman and managing director of Brook Motors, Ltd., recently returned from a business trip to the Middle East, India, Malaya, Australia and New Zealand.

McKechnie Bros., Ltd., announce that **Mr. D. Rae**, a departmental director of the company, has been appointed general manager at Birmingham.

Brigadier J. V. Topham has been appointed secretary of the British Engineers' Association in succession to **Sir William Christie** whose resignation takes effect this month.

Expansion in order to protect their own interests was urged by speakers at the annual dinner and dance of the West London branch of the **Association of Supervising Electrical Engineers**, held in the Clarendon Restaurant, Hammersmith, on 6th January. Mr. T. G. N. Haldane, president of the

Mr. J. G. Lowe

Mr. E. Salmon

Mr. D. Thomson

Mr. E. Tankard

Association, said he thought that the bulk of membership of the Association came from the section of the electrical industry generally known as utilization, but there were many others in the whole field of electrical engineering. The problem was particularly to cater for the needs of that large category of supervising engineers whose needs were not at present met. Mr. Haldane's plea was supported by Mr. A. Brammer, national general secretary. The branch chairman, Mr. A. W. Pelerin, and Mrs. Pelerin welcomed the guests.

Mr. R. K. Spencer has been appointed assistant chief engineer of E. K. Cole, Ltd. The position is one which has not been filled for some time and Mr. Spencer has, in fact, been acting partially in this capacity in addition to his work on quality control.

Mr. R. K. Spencer

Mr. C. J. Hodges has been appointed works manager of the Hoover (Electric Motors) factory at Cambuslang, Lanarkshire, as deputy to Mr. T. E. Groutage, director and general works manager. Mr. Hodges, who is fifty-two, joined Hoover, Ltd., as assistant chief inspector in 1943 and was made chief inspector at the end of the war. In the immediate post-war years he has taken part in technical missions on behalf of his company to Switzerland, Sweden, Canada and the U.S.A.

Dr. O. H. Wansbrough-Jones, C.B., O.B.E., has been appointed Principal Director of Scientific Research (Defence) at the Ministry of Supply. In order to take up this appointment he has relinquished his post of scientific advisor to the Army Council.

The Earl of Verulam, chairman and managing director of Enfield Cables, Ltd., has accepted an invitation to become an additional Patron of the Purchasing Officers' Association.

Sir Archibald McKinstry has retired from the board of Babcock & Wilcox, Ltd., as he wishes to reduce his business activities.

Sir Francis Brake, managing director of Creed & Co., Ltd., since 1933, has been elected chairman of the company in succession to the late Sir Frank Gill.

Mr. W. H. R. Nimmo, Commissioner for Irrigation and Water Supply in Queensland and a member of several hydro-electric authorities, has been awarded the Peter Nichol Russell Memorial Medal for 1950 for notable contributions to the science and practice of engineering in the Commonwealth.

Mr. C. A. Clench, M.I.Mech.E., M.Inst.F., has been appointed chief generation engineer (construction) of the London Division, British Electricity Authority. Following a broad engineering training on power station work with the British Thomson-Houston Co., Ltd., at Rugby, Mr. Clench joined the London Power Company in 1927 and until vesting day was a senior constructional engineer with that company. Since April, 1948, he has been largely responsible for the London Division's construction programme for the new Bankside and Deptford East stations and the Woolwich extensions.

Mr. C. A. Clench

We are informed by the Uganda Electricity Board that **Mr. W. G. Gray** has been appointed administration officer on the secretary's staff and not chief administrative officer to the Board as stated in our issue of 3rd November.

Mr. J. Muil, A.M.I.E.E., who has been for the last five years with the Technical and Scientific Register of the Ministry of Labour has been appointed registrar and secretary of the Professional Engineers' Appointments Bureau, 9, Victoria Street, Westminster, S.W.1, with effect from the 1st January in succession to **Mr. H. J. Nichols,** C.I.E., D.Sc., M.I.C.E., A.M.I.Mech.E., who has resigned.

The annual presentation by Sir Vincent de Ferranti of gold watches and certificates to long-service employees who have been with **Ferranti, Ltd.,** for forty years or over, took place recently. Twenty-three people qualified during 1950.

A profit sharing scheme has been introduced by the directors of **Holden & Hunt, Ltd.** First payments under the scheme are to precede Christmas of 1951, the amount to be shared being not less than the total shareholders' dividends. To mark the occasion employees received on the pay day previous to Christmas, 1950, a standard week's wages, in addition to normal earnings.

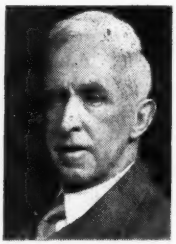
The **Electro Mechanical Manufacturing Co., Ltd.,** recently held its annual dinner at the Clifton Hotel, Scarborough. Guests at the dinner, organized by the firm's sports, welfare and social club, were Mr. J. Tyne and Mrs. Tyne, together with long service members of the staff.

"Diamond H" Switches, Ltd., held their annual Christmas party at the Star and Garter Hotel, Kew, on 22nd December. Mr. C. A. Turner, managing director, gave a short

address and during the course of the evening Mrs. Turner presented long service emblems to thirty-one employees. The company also held its annual children's party in the St. James' Hall, Chiswick, on 6th January.

OBITUARY

Dr. H. R. Wright.—The death occurred on 13th January at the age of seventy-three of Mr. Henry Robert Wright, Ph.D., chairman and managing director of Siemens Bros. & Co., Ltd. Dr. Wright was educated at the Polytechnic, Regent Street, the technical high schools Munich and Karlsruhe and at Munich University. He went to Siemens Works, Vienna, in 1902, and later to Siemens Works, Stafford, taking charge of the experimental test house in 1904. In 1907 Dr. Wright went to Siemens Works, Woolwich, being appointed general manager of Siemens Bros. & Co., Ltd., in 1925 and managing director in 1926. He had been chairman and managing director since 1946. His inventions included a train lighting system based on armature reaction; an electro-hydraulic system of ship steering and forerunner of the predictor. He initiated the prototype of the "Hais" cable through which 172 million gallons of petrol were conveyed across the Channel for the European invasion (Operation Pluto).



The late Dr. H. R. Wright

Mr. W. E. Gough.—The death occurred on 10th January of Mr. W. E. Gough, A.M.I.E.E., of the aero-magneto engineering and design staff, Coventry, of the British Thomson-Houston Co., Ltd. Mr. Gough, who was born in 1900, attended the Croydon Secondary School before studying at the Finsbury Technical College, where he obtained his City and Guilds Certificate. He served for a time in the Royal Marines, and on demobilization joined B.T.H., Rugby, in September, 1919, as a student apprentice. In December, 1922, he joined the magneto engineering and design staff at the Coventry works where for many years he specialized on aero-engine ignition. Mr. Gough married Miss Marjorie Satchell, sister to Mr. H. L. Satchell, M.B.E. (director, B.T.H., and manager Rugby works).

Mr. H. W. C. Liddiard, a member of the Industrial Engineering Department of the British Thomson-Houston Co., Ltd., since 1921, died on 4th January. Mr. Liddiard, who was fifty-five, had been with the B.T.H. Co. for thirty-six years. From September, 1914 until July, 1921, except for a period during which he served in the R.A.F., he held various positions in the Test Department, Rugby. Since 1921 he had devoted most of his time to mining problems, particularly those associated with the design of electric mine winders; a number of patents are in his name. After the last war he visited Germany and Holland as a member of the B.I.O.S. mission appointed to investigate Koepe winding practice. In addition to mining, Mr. Liddiard spent considerable time on the solution of power system and other technical problems. He took an active part in the project which resulted in the establishment of the A.E.I. network analyzer (installed at Willesden).

Mr. Charles Anthony Holbrow, who has died at Darlington, was well known in the electricity industry. Born in 1863 he was educated at Uppingham and studied electrical engineering. From 1886 to 1888, he worked on the installation of the electric lighting on Paddington station and hotel, London. He then became an engineer for the Metropolitan Electric Supply Co., Ltd. In 1901 he went to Australia and installed electric lighting in Kalgoorlie. Later he went to Amsterdam and started the tram system there. In 1904 he was appointed to the staff of C. A. Parsons & Co., Ltd., Newcastle. He retired in 1934.

Mr. H. Fildes.—The death is announced of Mr. Harold Fildes which occurred on 22nd December, at the age of sixty-four. The cremation took place at Manchester Crematorium on the 28th December. Mr. Fildes joined the Hotpoint Electric Appliance Co., Ltd., in 1936 as sales manager in the northern area organization and continued in this capacity up to 1940 when the growing armament programme drastically curtailed the company's domestic activities. During the last few years he represented Hotpoint in Liverpool, North Wales and the Isle of Man. Except for a short break of three and a half years, Mr. Fildes had spent the whole of his business life with one or other of the A.E.I. group of companies, having joined the group as an apprentice to the then British Westinghouse Co., in September, 1902.

The late Mr. H. Fildes

Mr. C. J. B. Gregg.—We regret that in reporting the death in our last issue of Mr. C. J. B. Gregg, director and also branch manager of Falk, Stadelmann & Co., Ltd., Glasgow, his name was incorrectly given as Clegg.

Electricity Development in the Punjab

Government's Programme of Construction

By J. H. APPLEBY, A.M.I.E.E., A.M.I.Mech.E.
(Chief Engineer, Punjab (Pakistan) P.W.D., Electricity Branch, Lahore)

THE partition of the Punjab in August, 1947, and the subsequent disturbances, mass migration and influx of a large number of refugees brought electricity supplies in many towns of the province to a standstill. Out of thirty-five electricity supply undertakings twenty-one were abandoned by their non-Muslim owners and conditions generally became chaotic. The staff, which was mostly non-Muslim, also migrated to India and very few skilled personnel were available to take charge of the various plants.

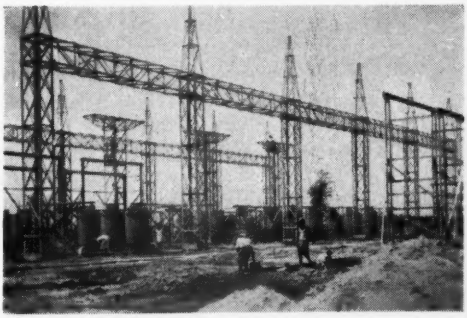
The other undertakings, fortunately enough, were either managed by the Government itself or were in safe hands. The abandoned undertakings, chiefly diesel stations, have since been taken over by the Government and are being run and maintained by the Electricity Branch, P.W.D. The only hydro-electric generating station in the undivided Punjab, situated at Jogindernagar, fell to the share of India along with the major portion of the transmission systems; so only about 100 miles of 66 kV lines feeding nine towns, including suburbs of Lahore, were left with the Punjab (Pakistan). A restricted supply to the nine towns is still continued under an agreement with the Punjab (India) Government.

A load survey of the Punjab has revealed that the maximum demand for power for industrial and domestic purposes during the next six years will be about 55,000 kW. This total does not include the area served by electricity supply companies run by licensees. In addition, a further demand of about 50,000 kW exists for tubewells required for irrigation purposes and for fighting the water-logging menace in the Punjab. The maximum demand of the province that can be met at present (omitting plants of the supply companies not managed by the Government) is 11,000 kW. Thus the great necessity for the immediate development of more power is manifest.

With a view to meeting the demand for electric power the Punjab Government has decided to construct several "hydel"* and thermal stations in the province. The work on one of them, the Rasul hydel scheme, which was started before partition, was seriously retarded due to the disturbances and also by inability to obtain certain essential materials. However, the work is now proceeding with great speed and this project will be ready in the near future. It is expected to provide 14,000 kW of firm power with a maximum of 22,000 kW.

This project involves the construction of a power house at Rasul where water of the

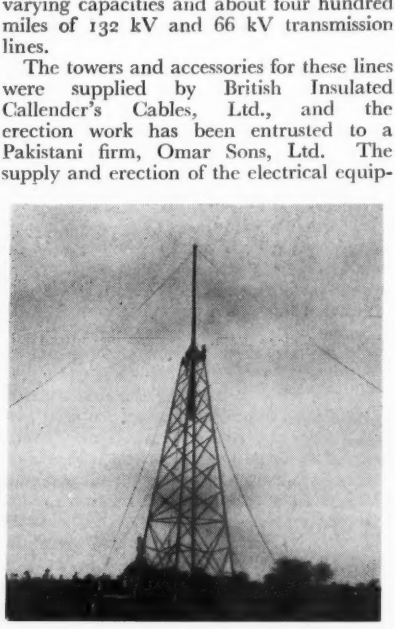
*This term denotes the water power of irrigation canals as distinct from natural river schemes.



Gujranwala 132 kV grid substation

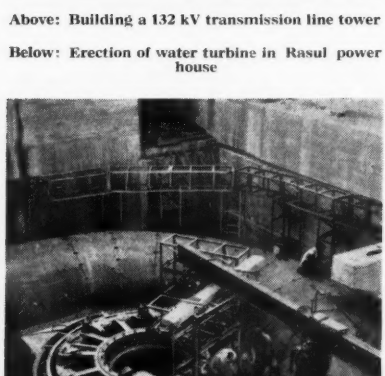
Upper Jhelum Canal is to be dropped 80ft and discharged into the Lower Jhelum Canal after passing through the machines. Associated with this scheme is the construction of fifteen grid substations of varying capacities and about four hundred miles of 132 kV and 66 kV transmission lines.

The towers and accessories for these lines were supplied by British Insulated Callender's Cables, Ltd., and the erection work has been entrusted to a Pakistani firm, Omar Sons, Ltd. The supply and erection of the electrical equipment for the power stations and the substations is being carried out by the Associated Electrical Industries (Pakistan), Ltd.



Above: Building a 132 kV transmission line tower

Below: Erection of water turbine in Rasul power house



Another hydro-electric scheme, where the discharge of a canal can be utilized through a 40ft head, has been seriously considered and preliminary work on it has already started. This hydel station will be connected to the Punjab grid system by means of a 132 kV double circuit line. The station will be completed in two stages; the first stage, which is likely to mature during the next six years, is expected to furnish about 27,000 kW. The power available from Rasul and the above-mentioned station may be utilized for industrial and domestic purposes, but the entire power from these two schemes will ultimately be used mostly for irrigation tubewells schemes.

Meanwhile in order to satisfy the interim industrial and other demands of the province before the hydel stations are commissioned, several thermal stations have been approved by the Government. It is intended to erect a steam station of 23,000 kW installed capacity at a central point; work on the installation of the power house has already commenced and it is also proposed to provide a 10,000 kW diesel station which will be commissioned at least 12 to 18 months before the steam station is ready. Together these stations will supply 33,000 kW to the 132 kV grid system.

It is further proposed to erect a thermal station of 6,000 kW capacity in a part of the province which, at present, is remote from the grid system, to cater for the needs of several townships through a 33 kV overhead ring to an existing power station which is at present feeding the metropolis of the Punjab. Abandoned company undertakings that cannot be connected to the Punjab grid are being independently developed and it is expected that the total installed capacities of these stations will be increased from the present 4,000 kW to about 9,000 kW during the next six years.

It is also proposed to interconnect the Punjab and the North-West Frontier Province grid system by means of 132 kV lines in order to carry surplus hydro-electric power to the Punjab from the North-West Frontier Province. The Central Engineering Authority, Government of Pakistan, Punjab and North-West Frontier Province Governments, and Messrs. Merz

Rendel Vatten (Pakistan), consulting engineers, are working in close collaboration for the evolution of a super-network to which will be interconnected the various power stations, hydel and thermal; the latter, upon the commissioning of the hydel stations, will become peak stations. When all these schemes are completed it is expected that it will be possible to satisfy the power demand of the Punjab during the next decade.

I wish to emphasize that few people realize the difficulties of organizing the altogether disturbed services of electricity supply in the Punjab province and that the achievements so far in keeping the services going cannot be minimized. During the short period of three years enough staff has been trained to handle the plant and equipment efficiently and a central workshop has been established in which repairs and overhauls of all sorts can be done, especially to diesel engines, in order that industry may flourish and the amenities of the vast population be preserved. In the last nine months, particularly, certain important decisions have been taken by the Government to rehabilitate the existing services and to prepare new schemes. A great deal of planning has been done and in spite of numerous difficulties, every effort is being made to put the plans into action.

Electrical Fair Trading

THE annual report of the Electrical Fair Trading Council covering the twelve months ended 30th September, 1950, states that the work of the Council continues to keep pace with the requirements and developments in the industry. Many of the problems which have arisen since the nationalization of these supply undertakings remain unsolved, but whilst the sections of the industry are prepared to meet round the common table of the Council and in its forum continued to consult before taking unilateral action which might disrupt the established trading structure, the second half of the century can be approached with confidence.

The fourth edition of the Policy became available in June and has been widely circulated. There have been more changes in the Policy since the third edition was published in October, 1945, than at any time since its introduction—involving the revision of some of its definitions, the introduction of some entirely new definitions, the amplification of the general principles and certain schedules, and the inclusion of two entirely new schedules dealing with water heating appliances and fans of the ceiling and desk types. During the year more commodious accommodation for the secretariat has been obtained in Sardinia House, Kingsway, London, W.C.2.

The Council's constitution has been revised, a slight adjustment being necessary in respect of the Electricity Act, 1947. An entirely new feature has been introduced which allows the election to membership of any person, not necessarily in the electrical industry, whose experience would enhance the Council's work and objectives. The particular position in the industry of the English and Scottish Co-operative Wholesale Societies, for terms, has been actively examined.

Contacts with the representatives of the various sections of the electrical industry in Australia, South Africa and New Zealand have been maintained in an endeavour to render assistance to the protagonists of Fair Trading Codes in those countries. In common with the experience of those who brought the policy for the home trade into being, the progress made, as yet is slow. However, an actual start has been made in Australia with one of the Policy schedules and it is hoped to bring other schedules into operation by progressive steps.

Mr. V. Watlington and Mr. T. W. Heather have been elected independent chairman and vice-chairman respectively for the current year.

E.I.B.A. Hants & Dorset Ball

THE first annual Ball in aid of the funds of the Electrical Industries Benevolent Association to be held by the Hants and Dorset Branch, has been arranged, in conjunction with the Southern Division of the British Electricity Authority, to take place at the South Parade Pier Pavilion, Southsea, on 26th January. The programme will include a cabaret, and prizes to be distributed at the Ball have been donated by leading manufacturers, wholesalers, and contractors in the industry. Tickets are priced at 10s 6d including buffet, and can be obtained from Mr. A. Cadman, secretary of the Branch, British Electricity House, High Street, Portsmouth.

VIEWS on the NEWS

By REFLECTOR

FROM the account given by us last week of the new Grid Control Centre, it is clear that a large amount of most intricate work was entailed in the change over from the two Centres previously in use. I am informed that, although work on the foundations was started only on 26th June, the office staff was transferred there on 25th November and the control rooms were in use a week later. Credit is due to the ingenuity as well as the enthusiasm of the permanent staff. Visitors would not suppose, for instance, that among the neat bits of improvized equipment is an entirely home-made wall diagram on which the grid lines are indicated by adhesive tape.

* * *

The fuel crisis has inevitably brought out the " Co-ordinators " who for some strange reason have a down on electricity. Dr. F. E. Simon, Professor of Thermo-dynamics, Oxford, made a number of proposals in the *Financial Times* for achieving fuel economy; one was the cutting down of the use of electricity for heating and cooking by imposing a prohibitive charge for all consumption above a certain number of units reserved for its " legitimate " use. Mr. A. A. Bretherton, in a letter commenting on the article, refers to Dr. Simon's cool disregard of the question as to who is to determine how much use is " legitimate " in any and every individual case.

* * *

For the first time, I believe, a programme designed to foster better household lighting by the use of definite basic " recipes " has been launched in the United States. It is claimed that by the end of 1951 some ten thousand demonstration homes throughout that country will be showing homemakers how to reap the benefits. The " recipes " seem to call for the provision of many more table lamps, floor standards and wall brackets than has been customary, but I don't see how each member of the household is to be persuaded to do the same thing at the same place every time with the lamp always correctly positioned—sometimes within nine inches.

* * *

It was about ten months ago that the B.E.A. collier *John Hopkinson* ran into Battersea Bridge and damaged the centre span, putting the bridge out of action. Repair work has been going on ever since and the bridge was re-opened to traffic on Wednesday. Having regard to the cause of the trouble it was a nice thought to take the opportunity of changing over the lighting from gas to electricity. *The Times* puts the cost of the repair work at £35,000, most of which will be found by London ratepayers. Under the Merchant Shipping Acts the owner's liability is limited to £8 a ton. the *John Hopkinson* has a registered tonnage of 1,300.

* * *

Nobody south of the Tweed is so persistent in his protests against the shortcomings of the electricity supply authorities as the Scots. But I detect a sign of weakening: the Selkirk Town Council recently decided that it would not protest to the South East Scotland Electricity Board against power cuts. One member said that to protest " would be like throwing peas at an elephant. Practically every local authority in Scotland has protested and nothing has been done."

* * *

Last week a bus crashed through the parapet of Lambeth Bridge, but by a stroke of luck stopped at the edge and so avoided consequences which would have been serious if it had toppled into the river. There were no casualties. I hear that on the side of the bus was a Siemens advertisement featuring a black cat, and while I doubt whether this saved the bus from careering into the river, there are probably some people who will credit the feline with yet another life-saving act.

Dr. J. W. T. Walsh

The Trotter-Paterson Lecture

The Early Years of Illuminating Engineering

THE origin of illuminating engineering in this country was the appropriate subject of the first Trotter-Paterson Memorial Lecture, which was delivered at the Royal Institution in London on 17th January.

In it Dr. J. W. T. Walsh (Light Division, N.P.L.) described the work of pioneers and traced the influence of the Illuminating Engineering Society on the cultivation of better appreciation of the importance of the specialized study of lighting problems.

The movement probably started in 1892 when A. P. Trotter read his classic paper on "The Distribution and Measurement of Illumination" before the Institution of Civil Engineers. In the early 1880's he designed a dioptric system for re-distributing the light from an arc lamp so that it would produce a uniform illumination over an extended area. In 1883–4 he assisted Sir William Preece in what must have been some of the first measurements of illumination, as such, ever made; they were in connection with the lighting of part of the City of London by electricity. Trotter in his "Reminiscences" confirms the view that Preece was the first man to appreciate the importance of measuring illumination.

Interest in the subject spread very gradually, at first only among engineers. In 1908 Leon Gaster founded "The Illuminating Engineer," which journal is now named "Light and Lighting," and soon afterwards proposed the formation of the Illuminating Engineering Society.

The first president was Prof. Silvanus P. Thompson, and J. S. Dow, who had been associated with Gaster from the inception of the journal, also took a full share in running the Society, terminating with his death in 1948.

The year 1911 was notable for the enthusiasm with which members of the I.E.S. devoted themselves to the task of satisfying the need for more widespread education in illumination matters. The Institution of Electrical Engineers, the Institution of Gas Engineers and the Association of Municipal and County Engineers set up a joint committee that produced the first attempt at a street lighting specification, which caused no inconsiderable amount of controversy. So does history seem to repeat itself.

In 1912 the Home Secretary set up a Departmental Committee to inquire into, and report on, the lighting (natural and artificial) of factories and workshops; in 1915 its report was issued in three volumes. Although it had no legislative force, it helped very greatly to improve the lighting of factories between the wars.

The use of the daylight factor for expressing the quantitative aspect of daylight at any point in a building was first suggested by A. P. Trotter in 1895. It had been subsequently much used by P. J. Waldram who pioneered, at any rate in this country, in the study of daylight and made considerable use of the device, generally known as a "daylight attachment" to an illumination photometer, devised by Trotter.

Education and self-education continued; at a meeting of the Society in May, 1914, Trotter read a paper on "The Nomenclature and Definition of Photometric Magnitudes and Units" in which he made disparaging remarks about the introduction of luminous flux and the lumen as one of the fundamental ideas in illuminating engineering. In the subsequent discussion Paterson took up the challenge concerning a term and concept which have now become second nature to every illiminating engineer.

Trotter became president of the I.E.S. in 1917 and held that office until the end of the 1919–20 session when he retired to Teffont and Clifford C. Paterson became the acknowledged leader in illuminating engineering, a position he owed to a combination of causes. He had built up the photometric section at the National

Physical Laboratory and during the 15 years that he was with Glazebrook there he did a great deal of pioneer work, much of it with B. P. Dudding, on photometric standards and light measurement. When he left the N.P.L. early in 1919 he began to build up a vast industrial research laboratory in which illumination research received a good deal of attention. He had succeeded Glazebrook as chairman of the B.S.I. Committee on Electric Lamps and, perhaps even more significant, he had been honorary secretary of the International Commission on Illumination ever since its formation in 1913 with only one break when he was president, 1928 to 1931. His tenure of that position, as the international leader in illuminating engineering, culminated in 1931 in the International Illumination Congress in this country.

MATERIALS HANDLING

THE principles affecting the handling of materials in industrial works were the subject of the lecture, illustrated with cinema films, which Mr. H. S. Carnegie (English Electric Co. Ltd.) delivered to the Association of Supervising Electrical Engineers this week in London.

It was pointed out that the handling of materials added to the cost of the product of the factory, but did not contribute to its value. Such handling should therefore be minimized, or made automatic; if the latter were not possible, then the movement should be done as quickly and cheaply as possible. When the quantity was large the movement should be mechanized to obviate physical effort and it should begin with the handling in bulk of incoming materials to the factory.

The handling of materials had been estimated to account for from 15 to 85 per cent of the cost of production, depending upon the type of factory. In other words an aggregate of 50 tons of materials might need to be handled to produce one ton of finished product. Greater savings could often be made by decreasing the time and cost of handling materials between processing stages than by speeding up the processing operations.

Mr. Carnegie borrowed extensively from the report* on "Materials Handling in Industry" and the objectives it emphasized. He explained that new factories should be built round the proposed handling system, which might well decide the layout and disposition of machinery; but existing premises, even multi-story buildings, could be adapted by improving the routing of materials and sequences of operations.

When mentioning different kinds of equipment the lecturer said there was obviously no "best" system of handling materials mechanically in all cases. Each must be studied to enable the requirements to be mapped out so that a choice of system could be made, in conjunction with the selection of labour-easing tools. In favourable cases the cost of such apparatus could be recovered in less than a year, but nowadays its installation was well worth consideration even if its cost would not be recoverable for several years.

For mechanical appliances like belt and chain conveyors operating continuously at constant speed, the simplest main drive would be by squirrel cage motors. For more complicated systems involving transfer of materials from one to another, on assembly line belt and platform conveyors, there was much to be said for a variable speed drive adjustable in fine steps to suit the operators and associated conveying systems.

Regarding the use of power driven trucks, the lecturer's view was that battery-operated trucks should show to advantage even when cost of battery replacement was taken into account. It would be advantageous to mount charging gear on the truck so that the battery could be refreshed by plugging-in to any a.c. power socket during waiting intervals.

The introduction of mechanical handling aids would directly affect the factory workers. Alterations should consequently be discussed before they were made to workers to be transferred to, or absorbed in, other sections of the factory. The object of economies of this kind was not to reduce the number of employees, but to increase the capacity of the factory which, ultimately, would require more people to deal with the enlarged output.

*Anglo-American Council on Productivity, 21 Tothill Street, London, S.W.1, price 2s 6d.

Commerce and Industry

Metal Shortages

Infra-Red Heating Application

ON the 10th January representatives of the Birmingham Chamber of Commerce discussed with the Ministry of Supply and Board of Trade the effect on Midlands industry of the Ministry's proposal to prohibit the use of copper, zinc and brass in the manufacture of certain products. Representatives were also present from the Birmingham sections of the Federation of British Industries, the National Union of Manufacturers and the Engineering Industries Association. The members of the deputation made the following points :—The potentialities in respect of rearmament of the quite considerable number of manufacturers concerned are important; the impact upon exports, many of the firms most hit being large exporters; the desirability in the national interest that the productive capacity set free by whatever measures are ultimately found necessary should receive special attention; the practicability of the substitution of other available materials was very limited; manufacturers affected would in most cases have limited stocks of restricted materials; they would also have work in progress. Could these be used after 1st February? In reply representatives of the Ministry of Supply and Board of Trade said it would be indefensible to allow raw material to be used for production which was clearly inessential at a time when vital production was held up by shortages. They did not feel that the date of the prohibition could be postponed, but they would consider allowing firms to use up reasonable stocks of materials and partly fabricated work in progress at the end of January. They were not in a position to indicate what Government policy would be on the regulation of imports and exports of the products in question; these matters were being considered.

Production Control

The manager and his foremen need sufficient information to control production without having to carry everything in their heads. This need is met by "Production Control in the Small Factory," published by the British Institute of Management, 8, Hill Street, London, W.1 (price 2s 6d post free). This is a revised edition of Part II of the British Standards Institution Series 1100. These publications were originally written for firms engaged on armament production, but most of the information can be applied to any factories with small and medium-sized batch production of fairly simple articles. A publication of more general application is being prepared by the B.I.M. The extensive use of tabulation should make this booklet a simple reference book especially for the manager of the small undertaking. The main revisions have been the elimination of sections on cost comparison and the labour analysis schedule, and the inclusion of a diagram showing the organization of a small works.

Rubber Testing

The scope of the revised version of B.S.903, first issued ten years ago, has been widened to include synthetic as well as natural rubbers. A great number of methods of testing vulcanized rubber, which have since come into general use, have been added to the original method. There is, however, no implication that all of them are appropriate to, or suitable for, all types of vulcanizate. Neither does the document as now revised contain all test procedures which it might be desirable to standardize. It has been deemed wiser to defer the inclusion of some methods which require to be further investigated. Copies of the revised specification (a bound book of 43 pages with 60 figures) are obtainable from the British Standards Institution, 24, Victoria Street, London, S.W.1, price 21s post free.

German Industries Fairs

Entrance tickets for the Light Industries Fair (28th February to 4th March) and the Heavy Industries Fair (29th April to 8th May), which are being held in Hanover, have now been received by Schenkers, Ltd., 27, Chancery Lane, London, W.C.2, the official agents in Great Britain. Tickets are 16s 6d each and holders are entitled to a reduction of one-third on the passenger fare on the German railways.

Watson (Electro-Medical)

From 1st February the address of Watson & Sons (Electro-Medical), Ltd., will be East Lane, North Wembley, Middx. (telephone: Arnold 6215). Since 1918 the business has been administered from Sunic House, 43-47, Parker

Street, Kingsway, London, W.C.2, and for several years past production has been carried out at the Union Works of the General Electric Co., Ltd. (with whom Watson's are associated). The move to North Wembley will bring together the factory and offices and showroom of the company.

Large Order for Spark Plugs

An order for one million spark plugs—the largest single export order in the company's history—has been received from Mexico by the AC-Sphinx Spark Plug Co.

Infra-Red Heating for Wood Finishing

The application of infra-red heating is a feature of the new hard-wearing, fire-resistant wood finish developed by Saro Laminated Wood Products, Ltd., Isle of Wight, and used on their "Sar-Rez" panelling for the interior decoration of ships, trains, caravans, etc. This finish consists of a liquid plastic which, when sprayed on to a timber surface and dried under radiant heat lamps, hardens and leaves a fire-resisting, resilient plastic coating. This coating can be either transparent or pigmented. The transparent coating is used where the panelling is decoratively veneered, the pigmented where plain colours are required. The use of infra-red for stoving this finish has been made possible by experimental work carried out in the Research Laboratories of the General Electric Co., Ltd., in collaboration with the manufacturers of the finish. After the boards have been stoved the resin is fully polymerized, hard but flexible, and ready for cutting to size and polishing as required. Alternatively, users can be licensed and the liquid resins supplied for operating the process on their own premises.

The infra-red plant has been designed to deal with panels up to 8ft in length and 5ft in width. The 216 "Osram" industrial infra-red reflector lamps employed are mounted horizontally and are suitably spaced with sheet metal of high reflectivity. Side and end reflectors complete the unbroken reflecting surface, which prevents the loss of stray radiation and maintains a high overall efficiency.

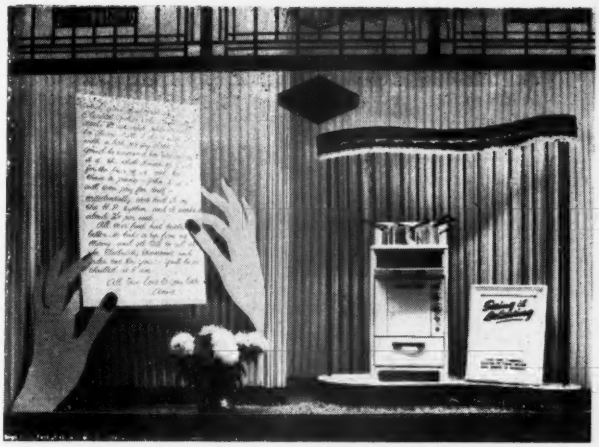
The lamps are arranged to form a bank 15ft long and 6ft wide, made up in three self-contained sections. Each section is rigidly held by a framework of angle iron supported in roller bearings an overhead girders. This method of construction allows each section to be easily withdrawn for cleaning and for maintenance purposes. Provision has also been made for altering the spacing between the lamps and the conveyor belt which carries the panels into the plant. This spacing can be varied between 12in and 20in to suit the work in hand. Access to the plant in the operating position is given through the side reflectors which are hinged to allow vertical movement. The conveyor has an overall length of 52ft and the 5ft wide woven wire belt is driven by a squirrel cage motor. The infra-red plant is wired for balanced connection to a 3-phase supply and is rated at 54 kW. The switching arrangement permits each row of lamps, each section, or half section to be switched independently.

G.E.C. infra-red plant for drying wood panelling

Window Display Competition

The North Western Electricity Board's third annual Service Centre window display competition again produced a high standard of workmanship from eighty service centres. The winner was the Hyde (Cheshire) Service Centre in the Board's No. 3 Sub-Area. The window was decorated in blue and white, and had for its main points an enlarged letter and a cooker. By this victory the Hyde Service Centre holds for one year the chairman's challenge cup for the competition and also receives a replica. Replicas also go to the winning entrants in the various preliminary Sub-Area competitions. These were: No. 1 (Manchester) Sub-Area:

Sale: No. 2 (Bolton) Sub-Area: Wigan; No. 3 (Oldham) Sub-Area: Hyde (final winner); No. 4 (Preston) Sub-Area: Fleetwood; No. 5 (Blackburn): Burnley; No. 6 (Lakeland) Sub-Area: Kendal; No. 7 (Stockport) Sub-Area: Bramhall. Judging was done originally on a Sub-Area basis, the finalists being considered by a main judging panel consisting of Col. J. S. A. Walker and Miss N. Kenyon (members of the Board); Mr. A. O. Johnson (the Board's chief commercial officer); Mr. J. M. Holmes (Principal, Manchester Municipal School of Art); Mr. A. R. Fasham (vice-chairman, Manchester Branch of the Incorporated Advertising Managers' Association); and Mr. N. H. Bridge (commercial development officer to the Board).



The window display at the Hyde (Cheshire) Service Centre

Brush-Aboe Diesel-Electric Locomotives

A new selling company has been formed to further diesel-electric locomotive sales of the Brush-Aboe Group and of its associate company, W. G. Bagnall, Ltd. The new company, Brush Bagnall Traction, Ltd., has its executive offices at the Falcon Works, Loughborough. It will handle all the diesel-electric or electric traction business of the combined Brush Group. The directors of the new company are Mr. A. P. Good (chairman), the Hon. A. C. Geddes (managing director), and Messrs. J. W. C. Milligan, W. A. Smyth, R. Bate, E. W. Marten, J. Calderwood, and J. T. Rymer. The sales manager is Mr. P. J. Martin.

Works Extensions

A £30,000 three-storey extension to the works of the Sheffield Twist Drill & Steel Co., Ltd., was opened recently by Mrs. Laure Dormer, widow of the late Mr. H. A. Dormer, first chairman of the company. The extension, which incorporates more production bays equipped with the most modern plant, will result in increased production of high speed steel twist drills and engineers' small tools.

Unscreened Camshaft Speed Magnetos

The British Standards Institution has just issued B.S. 1644: 1950, "Dimensions of unscreened camshaft speed magnetos," which forms one of a series relating to magnetos, dynamos and similar units for internal combustion engines. It deals only with the dimensions of unscreened, camshaft-speed magnetos (combined with distributor head) having shank and spigot mountings. The figures included are of typical magnetos and do not purport to represent standard designs or methods of locking the distributor head in position. Copies can be obtained from the B.S.I., 24, Victoria Street, London, S.W.1, price 2s 6d, post free.

Australian Electrical Trade

Imports of electrical goods into Australia during the first three months of the current financial year, namely July to September, 1950, totalled £A7,394,000 in value, as compared with £A5,039,000 for the same period of 1949, an increase of approximately 45 per cent. Some of the principal items are shown in the accompanying table, the figures for the corresponding

	Three months ended September,	
	1949 £A(000)	1950 £A(000)
Batteries and accumulators ..	55	157
Cable and wire, covered ..	1,310	1,167
Communication equipment, including radio	1,184	2,473
Dynamo-electric machines ..	1,130	1,263
Lamps, filament	135	233
Protective equipment	143	143
Regulating, starting and controlling apparatus	346	803
Transformers and rectifiers ..	98	380
Other electrical machinery and appliances	638	775

period of the previous financial year being added for purpose of comparison.

Exports from Australia of electrical appliances and equipment during the same period totalled £A340,000 in value, of which £A71,000 represented communication equipment, the corresponding totals in 1949 being respectively £A345,000 and £A126,000.

Zinc and Copper Restrictions

In referring to the provisional list of prohibited uses of zinc, copper and/or copper alloys in the article on zinc and copper restrictions in our issue of 5th January it would seem that we did not make the position clear with regard to tubes and fittings and conduit and conduit fittings in the category "general galvanizing." Under this heading galvanized tubes and fittings (other than water tubes), and galvanized conduit and conduit fittings are prohibited.

Electric Razor Explosion

The police authorities are trying to trace the person who sent an electric razor to Mr. H. J. Wright, manager of the Suffolk Sub-Area, Eastern Electricity Board. Mr. Wright received the razor from somebody unknown to him at Christmas. Enclosed was the business card of a man connected with a cable company who said that he had no idea how the card was obtained by the sender of the razor.

When Mr. Wright plugged in the razor a fuse was blown and so he returned it to the makers, Chilton Electric Products, Ltd., for examination. The company's chief inspector was testing the razor when there was an explosion by which he was injured. Examination showed that the mechanism had been removed and replaced by lead shot and an explosive powder. Police inquiries are continuing.

High Bay Lighting

We have been asked to point out that Mr. E. Smith, the author of the article on "High Bay Lighting," which he contributed on behalf of the Simplex Electric Co., Ltd., in our issue of 22nd December last, had before the article was published rejoined Philips Electrical, Ltd., as illuminating engineer in the Manchester region, he having previously been at the Philips' branch in Leeds from 1944 to 1948.

Trade Announcements

With reference to the notice in our 22nd December issue regarding the arrangement between Armstrong Siddeley Motors, Ltd., and Diesel Equipment, Ltd., for the latter company to manufacture a range of generating and lighting equipments incorporating the Armstrong Siddeley diesel engine, we are informed by **Superior Engineers (Watford), Ltd.**, that it also manufactures a range of generating plant (the "Armstrong Superior"), in close association with Armstrong Siddeley, Ltd.

Micramatic, Ltd., has established a branch office and stores at Britannia House, Wellington Street, Leeds.

British Moulded Plastics, Ltd., has purchased the complete equipment of the Plastics Department of Mansons, Ltd., including their complete range of starter battery moulds and cell lid moulds, and arrangements have been made to continue supplying their former clients at home and abroad. British Moulded Plastics' existing plant for handling bitumen asbestos compound has been installed in a new building at Avenue Works, Walthamstow Avenue, London, E.4, and it has created, as from 1st January, a bituminous division which will concentrate on making battery boxes, cell lids, insulators, etc.

Early in 1950, the Works Department of **The Lapointe Machine Tool Co., Ltd.**, moved to a new factory situated on the Watford By-Pass, the offices remaining at Edgware. The offices have now been transferred to the new premises, and all communications should be addressed to the company at Otterspool, Watford By-Pass, Watford, Herts (telephone : Gadebrook 3711-2).

Catalogues and Lists

A. E. Dees, Ltd., 24-26, Carliol Street, Newcastle-upon-Tyne, 1.—Priced and illustrated catalogue of electrical equipment and accessories.

Siemens Electric Lamps & Supplies, Ltd., 38-39, Upper Thames Street, London, E.C.4.—Priced catalogue (No. 1000) of electric lamps.

Hanovia, Ltd., 3, Victoria Street, London, S.W.1.— Folder on the "Detectolite" portable ultra-violet fluorescence lamp.

Sturtevant Engineering Co., Ltd., Southern House, Cannon Street, London, E.C.4.—Technical brochure (No. 6902) on a high efficiency cyclone dust collector.

Information Department

THE extensive records of our Information Department enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following:—

"Westco" Washboilers.

General inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by the Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Electrical Machine Design

Undergraduate Education

By PROFESSOR KENNETH ASTON, M.SC., M.I.E.E.

A PAPER was published in 1947 by Mr. L. H. A. Carr on "The Teaching of the Principles of Electrical Machine Design"* but its scope was restricted to teaching those who intended to specialize in this work or who were already engaged in it.

A problem which concerns a much larger number of men is whether electrical machine design should be taught as one of the subjects of a general electrical engineering course, in other words to undergraduates. This question has been debated for many years by students, teachers and engineers, but it is often doubtful whether the debaters themselves have a clear idea of what they mean by the expression "design" and other terms used in this connection. To begin with, everyone is agreed that if design is to be taught it should be only the "principles" of design, but it is fairly certain that the word "principles" conveys totally different meanings to different people. The word design is frequently used as though there is a clear and obvious distinction between it and the other parts of electrical machine theory, but there is a great deal of overlapping and much that is now considered to come under one head was considered formerly to come under the other.

Design and Procedure

It is also important to know whether any distinction is made between the terms "design" and "design procedure" for there is a considerable difference, and although one might reasonably contend that design can only be learnt in a design office, the same thing does not apply to "procedure." Several colleges in this country have abandoned the teaching of design to undergraduates on the grounds that 95 per cent of the men trained do not in fact go into design work, but is this a rational line of reasoning? If we apply the same test to the other subjects of an electrical engineering course there would be very little left.

The question is to decide whether design should be taught and if so, what should be taught under that heading and if not, what should be taught alternatively. The second consideration might be left to the discretion of individual teachers and colleges if we could feel sure that all teachers of the subject had had personal experience in a design office; but that is often not the case and without that experience a teacher can hardly be expected to have any real discrimination in the matter.

Suggestions for Syllabus

First, let us consider a few aspects of electrical engineering, apart from design, which are or should be taught in the design class and which probably can only be learned there. It is assumed that teaching is not to be restricted to those problems which lend themselves to exact mathematical solution. Although this view is implied by some statements which are made and although this would simplify the work of teaching and examining it would be misleading to students. One of the main things a student should learn is that the important things cannot usually be done without the aid of empirical data.

The calculation of flux, flux-densities, leakage flux, ampere-turns and the use of magnetization curves serve to teach not only magnetic circuits, ideas on which are usually hazy, but also arithmetic, in which students on the whole seem to be very deficient, particularly in colleges where they do not receive regular instruction and exercise in practical calculation.

When output coefficient is derived from first principles, viz., from the voltage induced in a single conductor, the chief point to be shown is that if all machines could be worked at the same gap density and the same armature loading the coefficient would be the same for all machines in the same class whatever the speed, voltage, or capacity. This theorem, as well as the foregoing, usually appears in textbooks on technology, but it is

* *Journal I.E.E.* Vol. 44, Part II, No. 41.

doubtful whether they are treated in a sufficiently mature way to convey their full implications to the student.

In d.c. machine problems there is a widespread notion, even among teachers, that the choice between lap and wave winding is optional, and it is only by working out dimensioned examples that the restrictions on the use of wave windings can be properly appreciated. Many students, even on leaving college, have the impression that if a machine is wave wound it has only two brush arms regardless of the number of poles, and that to provide more (for a multipolar machine) would be quite unnecessary and perhaps even wrong. This is representative of the misconceptions about machines which students derive where there is no design class.

Few academicians and even engineers, who have not had design experience appreciate the restrictions imposed on the building of d.c. machines due to the limit of the "volts between commutator segments."* It is not an uncommon idea that if electrical transmission were to be changed to d.c. the change in generation could and would be the simple substitution of d.c. machines for a.c. machines.

The calculation of interpoles is a very instructive process. Firstly, a student takes an appreciable time to digest the effects of placing a block of iron in the interpolar space, and the necessity for the balancing ampere turns. The calculation of the commutating flux is not, it is suggested, the sort of calculation that students should be burdened with except to see how such things are done and what methods are available. It is more profitable that they should know how commutation is dealt with in a factory, viz., by testing with a divertor or separate excitation of the interpoles and the subsequent modification, if required, of the design data for future orders of the same frame. In addition they will learn one important principle of factory processes and efficient production. The calculation of high reluctance interpoles for rotaries is also an instructive problem, although a more advanced theorem than the d.c. counterpart, the reasons for using a "high reluctance" pole and the "back gap" being very good practical instruction.

A.C. Windings

In the past it was common to treat d.c. windings in detail, winding rules and tables of various multiplex windings being used and much time spent on types seldom met in practice,† while at the same time no real understanding was gained of a typical case of, say, a wave winding with multiple coil sides per slot and multi-turn coils, and no attempt at all was made to deal with a.c. windings. Although these conditions have now abated a.c. windings and their characteristics still receive inadequate attention in the "technology" books. One thing is certain, however, that the teaching of obscure rules, whether for a.c. or d.c. windings or anything else, which can only be reproduced in the state of stress engendered by examinations from pure memory, should be strictly forbidden.

Graphical and Mathematical Solutions

The m.m.f. of windings was formerly taught only in the design class, but the graphical analysis now appears in "technology" books and is instructive. The mathematical analysis is more instructive still and should not be omitted from the syllabus as it affords an example of what has been done by mathematics; a complete explanation of what could be only crudely diagnosed by the graphical solution. In any case it should be taught as the converse of the "voltage" theorem as the latter determines, for a given winding, the electrical effect of a magnetic field, while the former determines the magnetic effect of an electric current.

In induction motor calculations the simplified diagram is always taught under technology as well as under design. It is doubtful whether, from the superficial attention it receives in the former, many assimilate the fact that it is derived on the assumption of constant working flux, which clearly cannot be true, that it is extensively used and gives reasonably good results in spite of that and that it is another instance of the semi-empirical methods so extensively used in engineering problems. Teaching from this angle is more helpful for general training purposes than trying to justify assumptions which are clearly incorrect.

When calculating magnetizing current, given the ampere turns per pole required, students find difficulty in realizing that the converse of the armature m.m.f. case is true, viz., given the ampere turns per pole the same equation can be applied to calculate the current, also that the armature reaction

* Electrotechnics, No. 21, 1949, p. 4. † Clayton—"Performance and Design of D.C. Machines," p. 71.

m.m.f. of the alternator is the main m.m.f. of the induction motor.

The position seems to be that if we abolish the teaching of design we must abandon exercises such as the calculation of efficiency from the manufacturing specification and comparison with measured figures, in favour of torque/slip characteristics based on hypothetical data and torque/speed curves from no other data than the resistance and reactance of the rotor.

Alternator Calculations

The load condition of an alternator, so far as the wattful condition is concerned is also treated under technology. Synchronous impedance, the ampere-turn method, Potier's construction, etc., are all covered but leave the student in a state of confusion regarding the relation and distinction between them. The same applies to synchronizing power and torque which is usually given as though it is a property peculiar to motors. In textbooks there are many pages of complicated geometrical constructions, usually based on the assumption that the armature effect is equivalent to a constant reactance, which would be simple if this were clearly stated, while in certain cases no distinction is recognized between "leakage reactance" and "synchronous reactance." As an indication of the confusion existing on this subject experienced teachers have been known to insist that an alternator having a synchronous impedance of 100 per cent is unworkable "because it cannot deliver any external power." An inspection of students' study books will reveal many problems and exercises in which synchronous impedance is quoted as 15 or 20 per cent, while it is safe to say that no synchronous machine for ordinary purposes has been made with a synchronous impedance as low as this since the last century.

Another aspect of the subject which many teachers fail to appreciate is the altered significance of the voltage regulation of an alternator, i.e., the change brought about by the building of larger units and larger stations together with developments in methods of voltage control, so that we find this subject expounded in some books and colleges as though the developments of the last 30 years had not taken place. This subject is one which is very badly in need of clarification and could very well be done by an experienced teacher in collaboration with a practising design engineer.

It will be seen that there is an important difference between design and procedure and perhaps the main objection to teaching design would not apply to teaching procedure, due to the elimination of "choice." The type of work indicated in the foregoing may be classified as procedure and should first be compared with the alternative work available for the teaching of electrical machine technology. After we have seen what is necessary and desirable to teach machine technology we may find very little left to complete the teaching of procedure. This process (procedure) might take the form of "analysing" the design of a number of machines which preferably have been made and tested. It should relate to machines of average features and made on reasonably modern lines. This would immediately exclude most college laboratory machines, except induction motors of not less than 5 or 10 h.p., since such machines are nearly always extreme examples of their type and these extremes are the least profitable for calculation of performance. Particulars can be readily obtained from the manufacturers, however, who are usually only too willing to help in these matters.

It may be said that having gone so far it is only a short step to design a workable machine (not a commercially competitive machine) made on modern conventional lines, not too large or too small, not too fast or too slow. To do this it would only be necessary to give the student a comparatively small amount of empirical information and instruction in modern manufacturing practice, such as insulation and methods of dealing with it, to supplement the knowledge already gained from analysis of designs. It is not necessary that an engineer should remember the figures or information given in this way but having once seen the way through the process it should have a pronounced and permanent effect on his "engineering temperament."

Conclusions

It appears desirable that the foregoing be discussed until definite conclusions are reached and detailed recommendations made for the guidance of those needing assistance and to promote uniformity throughout the profession. This affects in particular those who have to teach the subject without the backing of personal experience in a design office. For such teachers it is difficult to discriminate, to determine "what really

matters" and to separate methods and ideas which carry general agreement from those on which difference of opinion exists among practising design engineers.

Too much teaching should be guarded against and engineering courses should be periodically examined to see what can be eliminated, much time still being occupied with teaching what is little more than the legacy of a dead past. If design, and design procedure, is to be abandoned the alternative syllabus for giving instruction in "technology of machines" will have to be drastically revised and something will have to be done for students who insist on learning something about the first steps involved in making an electrical machine, unless the modern method of selection for higher education has already succeeded in eliminating all candidates exhibiting signs of individuality.

It is suggested that discussions should be held in different centres and recommendations formulated in detail which could be handed over to a mixed committee of engineers and teachers for collating and finalizing. In such recommendations all vague terms such as "principles" would have to be defined as unmistakably as possible. Alternatively, a committee of the I.E.E. might draft recommendations for a detailed syllabus and circulate it for written comments by interested members, employing approximately the same procedure as that used for the adoption of standards.

News from France

From Our Paris Correspondent

THE French Ministry of Commerce and Industry has announced that some £18,000,000 was spent in 1950 on the construction of new power lines and in increasing the capacity of lines serving rural communities. The Ministry admitted that this figure covered no more than half the demands made. There is likely to be a further cut in 1951 owing to lack of credits.

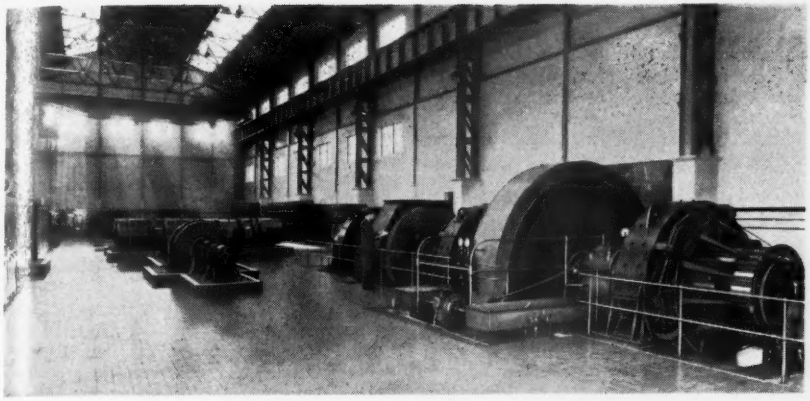
Under a law passed in 1949, power producing plant with a capacity under 8,000 kVA may be privately owned in France. It has now been decided to raise this limit provided certain conditions are fulfilled. The amendment will permit the construction of both thermal and hydro-electric plant exceeding 8,000 kVA provided the Ministry of Commerce and Industry grants a declaration that the plant will not compete with a public service. Further, that once the plant is constructed, the owners will enter into an agreement with Electricité de France. At present Electricité de France is not in a position to meet the full demand for power and is having to call for aid from small, privately owned plants.

In a memorandum sent by Electricité de France to the Economic Council, it is pointed out that although there is at present a margin of something less than 15 per cent between production and consumption, at any moment there may be a period of extreme cold and a fall in hydro-electric production may cut supplies. The Economic Council is asked to realize the importance of the nationalized electricity organization receiving priority over other enterprises in construction.

The memorandum points out that at the moment there is a shortage of houses in France and that the rearmament programme is not properly under way. Development of housing would make a greater call on electricity supplies. Regarding the rearmament programme it is pointed out that it is a dangerous thing to permit this important programme to depend upon the clemency of the weather.

The 1950 supply is put at 33,000 million kWh, 1,000 million kWh more than the "guaranteed" production. E.D.F. hopes that equilibrium will be reached in 1951–53 when "guaranteed" production should increase to 34,500 million kWh, 38,500 million and 42,000 million kWh respectively. But it points out that during that period the rearmament programme will get under way and consumption will be greater.

The French Privy Council has decided that a Ministry is not permitted to transfer the property of one nationalized industry to another. When French electricity was nationalized in 1946, all the power lines owned by the French railways were transferred to Electricité de France. In 1948, however, probably to aid the railways, the Government transferred the lines back to the railways. The E.D.F. challenged this right to make an arbitrary transfer.



Manufacturers' Activities—IV

Some English Electric Work during 1950

TURBO-ALTERNATOR sets manufactured by the English Electric Co., Ltd., which were commissioned for the British Electricity Authority during last year, included the 60 MW set with hydrogen-cooled alternator at Stourport, Worcs; one of 45 MW at Ferrybridge, Yorks; and the second of the new 30 MW sets at West Ham. At the end of the year further 30 MW sets were nearing completion at Clydesmill, near Glasgow, and at Llynfi, in South Wales, and two 20 MW sets at Peterborough. A 12,500 kW, 30 c/s set was also completed for the Staveley Coal and Iron Co. Orders confirmed by the B.E.A. included three 60 MW sets for Tilbury and two of similar output for Drakelow for 1,500 lb/sq in and 1,050 deg F.

Among smaller units ordered for use in this country were seven back-pressure sets (four of 5 MW and three of 3 MW) for oil refineries.

The most important export orders were for the sixth and seventh 30 MW sets for Vierfontein power station in South Africa and the third 60/66 MW, 60 c/s set to be installed in the Windsor power station of the Hydro-Electric Power Commission of Ontario.

The North of Scotland Hydro-Electric Board, following upon its policy of adopting single unit stations wherever possible, amended the Garry-Moriston project, the contracts for which were placed with the E.E. Co. in 1949. At Invergarry, one unit of the feathering propeller type with double the output originally contemplated is now to be provided, of 20,000 kW at 250 r.p.m., under a net head of 146ft and a maximum of 181ft, which is exceptionally high for this type of turbine. The output of the generator for Quoich power station has also been altered to 18,000 kW at 300 r.p.m.

The New Zealand Government ordered two further vertical shaft umbrella type generators for Waitaki in South Island, each of 16,667 kVA at 11 kV and 125 r.p.m.

The Hydro-Electric Commission of Tasmania ordered four 28,000 h.p. vertical reaction turbines for 370ft head and 375 r.p.m. and two 25,000 kVA alternators. The turbines will operate with water taken from the South Esk River tailrace and will discharge into the Tamar River near

Above: Ilgner set for main mill drive and two Ward-Leonard motor-generator sets for table and screwdown drives (behind) in the steel works of John Lysaght, Ltd., Scunthorpe

Launceston. To meet delivery requirements, parts of the turbines are being manufactured in Great Britain, other parts by the company's associates, the John Inglis Company in Canada, and further parts in Australia.

Herederos de Gines Navarro Martinez ordered two 16,000 kVA vertical shaft alternators, together with switchgear, for the Barrios de Luna station in Spain.

The Department of Public Works, New South Wales, ordered two sets for the station at the Hume Dam on the Murray River. The turbines are of the vertical feathering propeller type, each of 35,000 h.p. under 95ft head at 167 r.p.m. The generators are vertical shaft umbrella type, each of 27,778 kVA at 11 kV.

The first two turbines for the Aberdeen-Laxapana project in Ceylon were started up successfully. An order for three 14,500 h.p. horizontal impulse turbines, 1,474ft head, 600 r.p.m., was supplemented by a further order for three 22,000 h.p. turbines.

Diesel-electric generating installations augmented included Messrs. Bentalls' store at Kingston-on-Thames, by a 464 kW generating set, turbo-pressure-charged, with alternator, 25-panel switchboard and all associated electrical equipment.

Messrs. Harrods of Knightsbridge commenced to operate two 300 kW alternator sets and have ordered two more.

The Monotype Corporation, Ltd., of Redhill, Surrey, has a 520 kW 400 V set with waste heat recovery for space heating. Repetitions of previous orders included diesel engines for the Admiralty, the Crown Agents for the Colonies, the British Phosphates Commissioners, New South Wales, West Africa, the Sudan and for industrial and commercial concerns in Great Britain. The "diesel-power package unit," specially developed for oilfields and other undertakings where a mobile self-contained power unit is needed, can be operated on diesel oil or natural gas.

The demand continued for 33 kV transformers for the Area Boards and the manufacture of the first 275 kV transformers for the English grid has been proceeding. Important business was received from Australia, 220 kV 3-phase; from Tasmania, 110 kV; South Africa, 132 kV; and Finland, 3-phase 3-winding 220/110/11 kV. For the new Taaibos station on the Orange Free State Gold Fields, the 70 MVA 3-phase 132 kV units are of larger capacity than any at present installed in the southern hemisphere.

Orders for outdoor oil circuit-breakers cover the extensions to the Craigiebuckler 132 kV outdoor switching station for the North of Scotland Hydro-Electric Board, two complete 88 kV substations in South Africa for the Orlando station extensions and Johannesburg City Deep substation which included over thirty 88 kV breakers, two 66 kV outdoor switching stations for the Madras Government, forty 66 kV breakers for Australia and 33 kV breakers for Area Boards at home.

One of the largest orders for metal-clad indoor gear was a seventy-five panel 11 kV 500 MVA switchboard for an atomic energy establishment, forty 6 kV units for South Africa, 24 for Australia and others for India and New Zealand.

Among air-blast gear requirements were 110 kV circuit-breakers for the Hydro-Electric Commission of Tasmania, two 132 kV substations for the B.E.A., 132 kV breakers for Australia, 165 kV breakers for Spain and a complete 66 kV substation for the South Wales Board.

The growing volume of orders for pumpless air-cooled mercury-arc rectifiers reflects their widening uses. During 1950 the major applications were to steel mill main drives, some using grid control for starting and a combination of grid control and on-load tap changing for speed variation. The six 2,000 kW equipments supplied for the Estrada de Ferro Santos a Jundiai (late Sao Paulo Railway), Brazil, are believed to be the first pumpless air-cooled multi-anode rectifiers to be used for 3,000 V traction duty. An additional 2,000 kW equipment has been ordered.

Two further orders for electro-chemical installations made a total of six 10,000 A equipments for one group of companies.

Orders for tramway and trolley-bus service came from Glasgow Corporation, Helsinki Municipality and for underground mine haulage.

Activity in electrical plant for the metal industries predominantly concerned the steel industry. A large hot reversing mill drive was put into commission at the Scunthorpe (Lincs) works of John Lysaght, Ltd. Another drive commissioned was for a 45in hot slabbing mill at the Abbey Works of the Steel Company of Wales. This equipment is the first twin drive in the British steel industry and the largest

reversing drive in Britain.

To the hot strip mill equipment installed at John Summers' steel works near Chester by the A.E. Co., electronic control has been added recently without alteration to the generators and motors.

A hot strip mill drive installed abroad for producing narrow stainless steel strip includes a set of air-operated loopers for automatic control of strip tension in the finishing stands; this is believed to be the first control of this nature to be applied to a hot strip mill. A fourth cold tandem strip mill drive was supplied to the British Aluminium Co.'s works at Falkirk, making the fourth English Electric equipment installed there.

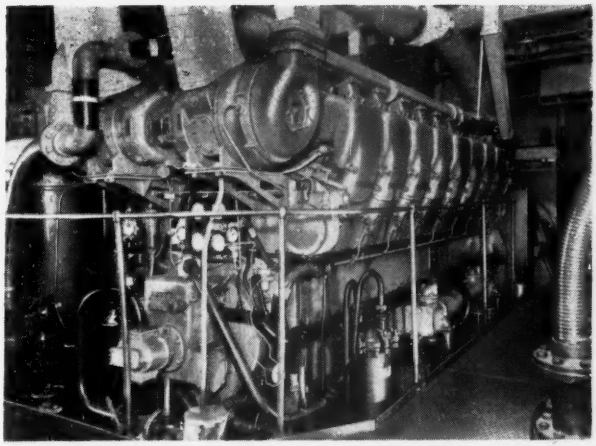
A reversing drive for a slabbing mill was delivered to the South African Iron and Steel Corporation's Vereeniging works, a repetition of two others in the same works.

A continuous mill in Bengal is to have English Electric drives; the four roughing stands will have individual d.c. 600 h.p. motors while the finishing stands will be driven by a 7,000 h.p. synchronous motor which will also drive the generator for the d.c. motors.

Orders for mine hoists and haulage equipments from the National Coal Board, South Africa, West Africa and India have been on an increasing scale while orders for textile mill drives involve some hundreds of motors and special control gear.

Work is proceeding on a frequency changer for Australia, which will be one of the largest of its type ever manufactured. It will consist of seven machines of an overall length of 63ft and a total weight of 420 tons.

A considerable increase in orders for medium and small industrial electric motors was mainly for driving machine tools, woodworking machinery, pumps, textile machinery and colliery plant.



One of the sixteen-cylinder turbo-pressure-charged engines in a large diesel-electric dredger of the Ministry of Public Works, Argentina

A range of special light-weight alternators of 58·5 to 130 kVA was developed for Rolls Royce engine driven transportable generating sets for carriage by air if necessary. A number of 2 kVA 500 c/s motor-alternator sets for use with Marconi radar equipment were also manufactured.

Locomotives for Spain and Australia are of new designs not previously built, but their general arrangement will be somewhat similar to that of the d.c. 3,000 h.p. electric locomotives now being delivered to the Estrada de Ferro Santos a Jundiai, Brazil. Much railway equipment is being made for British Railways, Tasmanian Government Railways and Netherlands Railways.

Machinery of the four diesel-electric dredgers which were built by William Simons & Co., Ltd., and Fleming & Ferguson, Ltd., for the Ministry of Public Works, Argentina, is giving satisfaction in service. Work was nearing completion at the end of the year on the propulsion machinery for the new Tay Ferry being constructed by the Caledon Shipbuilding and Engineering Co., Ltd., for the Dundee Harbour authorities and three 250 kW diesel generating sets similar to those made for the *Dunedin Star* of the Blue Star Line have been delivered for the Pacific Steam Navigation Co.'s s.s. *Cuzco*, being built by the Blyth Dry Docks and Shipbuilding Co., Ltd.

Railway Fluorescent Lighting

AN interesting scheme for the power supply for fluorescent lighting has been developed by the Metropolitan-Vickers Electrical Co., Ltd., in collaboration with the London Transport Executive, for the new "R" surface-line stock of London Transport. This is the first large scale application of fluorescent lighting to railway transport vehicles and the Metropolitan-Vickers Co. is supplying 179 generator and regulator equipments.

A notable feature is the dual-purpose motor-generator set with its associated voltage regulator equipment carried on the car underframe. The fluorescent lamps (24 per car) are operated in parallel from a 110 V a.c. supply. The use of resonant lamp starting obviates the necessity of automatic lamp starter switches. The provision of this a.c. supply has been made an additional function of the motor-generator set which was already essential to give a d.c. supply for control circuits, door operation, battery-charging, etc. To provide the a.c. supply a winding has been incorporated in slots in the pole faces of the generator; the slots are semi-closed and the a.c. voltage is induced as in an inductor type alternator.

The machine comprises a 600 V driving motor and combined d.c. and a.c. generators, all in one frame. The motor and generator armatures are carried between two bearings in a common yoke, thereby making a very compact unit. The d.c. output is 80 A at 50 V while the a.c. output is at 110 V 850 c/s and is sufficient to supply 72 20 W fluorescent lamps.

The regulation of the machine presented a difficult problem but this was solved by the use of one voltage regulator, of the standard traction vibration type, in a patented circuit. It operates upon the motor field, which is separately excited from the d.c. generator, and so maintains the speed of the set at a sensibly constant value. The generator is a flat-compounded machine and therefore, provided the speed is steady, the a.c. and d.c. voltages will not be affected appreciably by variations in load. The one voltage regulator thus fulfils three tasks; it keeps within close limits the speed (and therefore the frequency), the d.c. voltage and the a.c. voltage.

The substantially constant frequency has the further advantage that proper capacitor compensation in the a.c. circuit can be used. A main series capacitor compensates the internal reactance of the a.c. winding and makes the output voltage to a great extent unaffected by variations of the a.c. load. A parallel capacitor provides the wattless current from the set.

In addition to its separately excited field the motor has also a series winding for stability purposes and to assist starting. A permanent resistance is in the main motor circuit. The set is started up by direct switching on to the line.

Interior of London Transport "R" surface-line coach fitted with Metrovick power supply equipment for fluorescent lighting

ELECTRICAL CONTRACTING: Organization and Routine

By H. R. TAUNTON, A.M.I.E.E.

22.—*Standing Charges*

DO what he will, a contractor must spend money to make it. His standing charges will always be a heavy percentage of his turnover, and he must add that percentage to the net cost of every estimate before he can begin to think of profit. In practice it is more convenient to calculate the required percentage on the net cost rather than on the turnover. And the percentage must be *calculated*; it must not be guess-work, which would mean it would always be under-estimated. It is simply a matter of observing the proportion between the totals, shown in the previous year's audited accounts, of the standing charges on the one hand, and of the productive prime costs on the other. That percentage should be scrupulously adhered to during the whole of the current year. Until the results of that year's trading are known neither optimism nor despairing competition should persuade the contractor to reduce it.

Methods of Calculation

Some firms adopt a sliding scale, adding the full percentage for small jobs, but decreasing it systematically for larger ones. The argument is that certain of the charges do not increase in proportion to the amount of the contract—rent, for instance—while the increased turnover automatically reduces the percentage they bear to it. The flaw in the argument is that one big order does not necessarily make a good trading year. The system only becomes justifiable if, and after, the current year's turnover exceeds that of the previous year.

Other firms add differing percentages of standing charges to their labour and material costs, or even add the whole to labour only. The suggestion here is that overheads vary more in proportion to the man-hours worked than to the actual sales, and that it costs no more to sell a 50 h.p. oil engine than to sell a lamp. In such extreme cases, and where accounts for proprietary articles are concerned, common sense will dictate the relaxation of any rule. In average cases of mixed jobs, none of these varied systems works out very differently from the one first suggested, of a uniform percentage on the whole of the net cost.

An oncost is an overhead which definitely forms part of the cost of a job, varying with its amount : for instance, the wages of a supervisor. A standing charge on the other hand, such as the rent of offices, is largely independent of the number of man-hours worked in the year. The distinction is important in the calculation of manufacturing costs; but in a contracting business, where the work is done outside while the overheads are incurred in the office and stores, differentiation between the two classes is as needless as it would be difficult. It is simpler to deal with them as a whole.

First, " Rent, Rates, and Taxes." This covers the rental of all premises used in the conduct of the business, the local rates paid on them, and such Government taxes as are applicable, e.g., property tax. If the premises are freehold or leasehold, an amount equal to their letting or redemption value should be assumed for accountancy purposes. Any interest paid on mortgages should also be included in this account. What percentage the total will bear to turnover or prime costs will naturally vary with circumstances; but a provincial firm should be able to keep the figure down to 3 per cent or less.

Office Salaries

Salaries paid to the office and stores staff usually form the heaviest item of standing charges. Its proportion will tend to increase with the amount of the turnover. In the small " one-man " concern the contractor may combine in himself several functions for which he would otherwise have to pay; while in larger concerns a manager may be necessary, with a consequent jump in the total of the salary list. In any case, principals should pay themselves

and include in their standing charges an adequate amount for their services, if these are active. A logical method of calculating that amount is as that which would have to be paid to an employee doing the same work. The question is only one of correct book-keeping, since what the principal does not take as salary he takes as net profit. A reasonable figure would be 2½ per cent on the turnover. Where a principal, employing a manager, contents himself with general supervision, it might well be simpler for him to take his return in the single form of profit.

Where a manager is employed, with the main responsibility for the success of the business, he is the one member of the staff who should certainly be given a direct interest in the results of his work in the form of a percentage on the declared annual profits—say, 10 per cent—in addition to a basic salary.

Engineers and assistants are usually paid fixed salaries, varying with the circumstances of the firm and the age and experience of the man. The low pay of qualified engineers—the result largely of the law of supply and demand—is an admitted grievance; and certainly no young man with the training necessary to his work on a contractor's technical staff should be asked to accept less than £7 a week as a beginning.

Treatment of Supervisors

The fact that the supervisor, in contradistinction to the foremen he supervises, enjoys the certainty of a full year's incomef should not militate against his being paid a weekly wage definitely higher than the average wages the best of them can earn since his responsibilities are so much greater. Members of the A.S.E.E. receive salaries agreed with the N.F.E.A. The storekeeper, with rather less active responsibility, is usually paid a salary comparable with the wages of a permanently employed electrician, compensated by the enjoyment of staff privileges—including that of working overtime without extra pay. The accountant and his staff, the typists, and other clerical employees are paid on much the same scale as persons of similar experience in other trades in the locality.

As a whole, comparing the total salaries of the indoor staff with the total wages of the outside staff—since the two are largely interdependent—a reasonable proportion for a firm of average size would be about 20 per cent. Thus a firm with an average weekly wages bill of £400 may expect a salary list in the neighbourhood of £4,000 per annum. A smaller proportion suggests a staff too small or too ill-paid to ensure the smooth running of the necessary organization.

Representatives' Commission

The salary paid to the outside representative should be enough to keep him out of financial straits in the inevitable lean times, without being so high as to tempt him to be satisfied with it, and in consequence take things too easily. The question of his commission bristles with difficultues. Commission on turnover tempts him to go after unprofitable business, and commission on profits leads to the facile objection that he has no control over them. Too small a commission disheartens him; too large a one may eat up the contractor's profit. A sliding scale is full of pitfalls, particularly when " extras " are in question.

Commission on repeat orders, on orders from the firm's own connection, from the representative's original connection, from the connection he has made since joining, on orders resulting from inquiries handed to him to follow up, or initiated by him and followed up and secured by a principal: all these are points which must be envisaged and defined in any agreement with him. Whatever terms are mutually agreed, it is essential for the avoidance of disputes that ull weekly reports should be put in by the representative, defining the origin of every inquiry and order secured by him, against the time when he will want to claim commission on them. If there is any dubious item in his report, let it be argued then rather than later.

The item of " Commission " in the total of standing charges will also include that paid to canvassers, if employed, and bonuses paid to shop assistants or to the staff responsible for actual sales from a stand at an exhibition or agricultural show. And there are other commissions!

Incentives and Rewards

Discussion of salaries suggests the wider topic of incentives and rewards to the staff in the shape of bonuses or profit-sharing: a topic very much in the air to-day in all industries. There, in another sense, perhaps, it will remain. More perhaps would

be done if a practical scheme could be devised which would provide an adequate incentive where it is most needed—to the outside staff.

In the electrical contracting trade direct payment by results is impracticable. Without a fixed unit of output, piece-work is out of the question. Attempts made to accelerate progress on a particular contract by the offer of a bonus based on the saving of estimated labour are rarely successful. Even if the amount is sufficient to tempt the men—and it has to be definitely more than they could make by the extra hours they would work at their normal rate of progress—the almost inevitable result is that the quality of the work suffers. To give them a real and permanent stimulus implies a scheme which will offer rewards not arbitrarily limited nor small in proportion to their normal earnings, and withal definite and easily understandable by them and directly dependent on their individual efforts; and that means, logically, giving them full knowledge of the affairs of the firm and a voice in their control.

Allocating Expenses

"Expenses" and "Non-productive Labour" should be kept as small as possible (as standing charges) by booking to accounts in the cost ledger everything that can be reasonably considered a contract or chargeable item, such as travelling expenses of principals or engineers supervising country jobs. Labour expended on maintenance cannot well be included in a contract cost without falsifying the conclusions to be drawn from it. Moreover, it is desirable to know the amount spent yearly to meet the contingency, and such others as "Stores Upkeep", "Service," and so on. The greater part of the representative's expenses will be an unallocatable item; so will a considerable proportion of the "entertaining" expenses unavoidably incurred by most firms in the interests of present and future goodwill; and such other miscellaneous expenses as local fares of the office staff, subscriptions to trade organizations, donations to charity, and the like.

Associated with "Rent, Rates, and Taxes," but better kept under separate headings, are such items as expenditure on electricity, coal and gas for the offices, stores and showroom; regular cleaning and occasional repairs to the premises; and fire, burglary, and similar insurances. The total expenditure under these various heads should not, as a rule, exceed 20 to 25 per cent of the rent.

Cost of Stationery, etc.

"Stationery" should be separately accounted for, as it is always a substantial item of the administrative costs. Expenditure under this head should not be grudged, within reasonable limits. The value of good notepaper as an advertising medium has already been stressed; and it is a false economy to stint money on it, or on the various forms and books necessary to a full organization. Paper and print will always be cheaper than confusion and wasted time. "Postages" may include telegrams and telephone rents, or these may be separately accounted for. Telegrams and trunk calls directly connected with a contract, and postages on small parcels of material for it, may fairly be booked to its cost account, but it is impracticable to allocate ordinary postages.

Premiums for fire, burglary, and similar insurances may be entered in a general "Insurance" account. It is better, however, to allocate them to the separate accounts with which they are associated. National Health and unemployment insurances can be dealt with through the wages analysis book, the final figures only being transferred to a "nominal" account. The employer's contribution must not be overlooked: it is an overhead, since it is impracticable to book it to contract costs accounts. It may be necessary to take out a number of policies to cover the contingencies of a contractor's business. "Employers' liability" is an obvious one; and others may be desirable according to circumstances. N.E.C.T.A. has a comprehensive scheme of insurance available to its members.

If the firm runs a motor-van for the delivery of material, its upkeep and running costs are a standing charge, and should be entered under a separate account with the insurance premium, garage rent and driver's time.

Bad Debts

If in one year a heavy bad debt were incurred it could hardly be considered a normal standing charge. On the other hand, a proportion of bad debts is an accepted business liability of any firm

handling a large number of small accounts. The most logical way of dealing with them is to consider all losses falling within a prescribed limit—say, half of 1 per cent of the turnover—as a standing charge, and to treat any abnormal excess as a charge against profits. The same principle will serve for another item, "Legal Costs," which in a normal year will be concerned chiefly with those same bad debts or the avoidance of them.

Depreciation Charges

The last important item of standing charges is "Depreciation" of stock, tools, furniture and fixtures, and vehicles. The question of its treatment is always a difficult one, and many have very elastic ideas of the fair percentage to be written off annually on this account. Some calculate depreciation as a percentage of the previous year's depreciated value, the argument being that depreciation does not occur by equal instalments, and that while there is life there is value. It is more usual and simpler to calculate it as a uniform percentage of the original cost, such as will wipe out the cost as nearly as possible at the same time as the article reaches the scrap heap. It is a question of judgment in estimating its probable life, as in the simple case of the firm's motor-van. At least 25 per cent of its original cost should be entered to "Depreciation" each year, so that in four or five years the cost will be written off entirely.

The question becomes more complicated when we come to "Tools and Tackle" and "Furniture and Fixtures." Here we are concerned not with a single article, but with a collection of articles whose individual expectations of life may differ widely. Stocks will long survive an electric drill, and the office safe a dozen typewriters. The exact method would be to allot to each item its own percentage of depreciation. It is usual, however, to avoid so much complication by grouping them under the two headings, with an average percentage: say for tools and tackle 25 per cent per annum, and for furniture and fixtures 10 per cent.

Very much the same principles apply to the (book) depreciation of stock; but a new factor is introduced, as we have to provide not only for "wear and tear" but for varying losses due to a number of other causes.

The figures of the annual stocktaking appear in the balance sheet; and it is usual to take 10 or 12½ per cent thereof as "depreciation" to cover the year's losses from all causes: damage, deterioration, reduced market prices, and actual discrepancies. In reality, the true depreciation, for any one year, may be—generally is—very different, since it varies so widely for different items of stock. To work out piecemeal the true depreciation would be almost impossibly laborious and the figure must be left to the auditor. If it is reasonably selected, the results, taking one year with another, will approximate closely enough to facts.

What is the total of all these various overheads? Each item is of practical interest to the contractor, but the total is of special importance to him, since its proportion to that of his total prime costs will affect all his estimates for the current year. It is difficult to answer the question in averages and the only safe deductions to be made from the insufficient facts on record are that the percentage of standing charges in an electrical contractor's business, other things being equal, tends to vary inversely with turnover but is always much larger than any figure the uninstructed would be likely to arrive at by guess-work. Further, it is reasonable to suggest that any contractor starting in business, or without figures on which to base a calculation, should, to be on the safe side, work for a first year on the assumption that his standing charges will not be less than 30 per cent. It is not always easy to do this. When trade is slack for a long time overheads are disproportionately high, and to attempt to cover them in estimating would result in figures unlikely to be accepted. One can only then quote a price which, though it does not fully cover current expenses, will yet, if it secures an order, have the effect of reducing their future proportion.

Use of Graphs

Graphs can be devised to help in many ways a contractor's office work: his estimating and costing for instance. One or more that will show the proportion of total overheads to total prime costs, or to various fluctuating factors such as wages, material, total sales, net profits, and so on, will be found useful and, perhaps, unexpectedly illuminating.

RECENT INTRODUCTIONS

NOTES ON NEW ELECTRICAL AND ALLIED PRODUCTS

Floor Polisher Conversion Unit

With the aid of a "Polyvac" conversion unit made by C.M.C. (SWITCHMATIC), LTD., 53, Dyke Road, Brighton, any upright type of vacuum cleaner can be converted into a floor polisher. The weight of the machine has been counteracted by compensating springs so that the polishing surfaces revolve at maximum speed, while self-lubricating bearings ensure smooth operation and long life. The twin polishing rollers are of "Sorbo" sponge rubber covered with a soft but durable polishing sleeve which can be removed for cleaning or replacement. The unit sells at £4 7s 6d.

Dairy Cooler-Heater

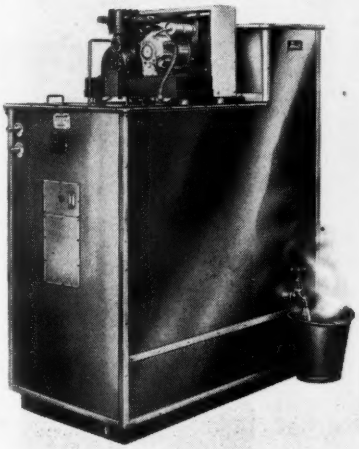
The "Snowfire" cooler-heater made by LOHEAT, LTD., Eddington Works, Hungerford, Berks, chills sufficient water to cool 100 gal of milk per day in the proportion of (morning and evening) milk usually produced, say, 60 gal of milk in the morning and 40 gal in the evening. The chilled water is circulated through the farmer's milk cooler and then returns to the plant, bringing back the heat from the milk with it.

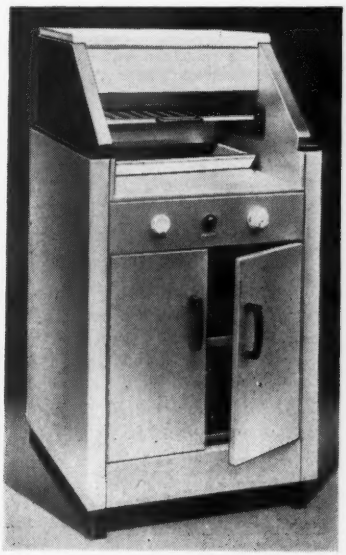
The milk heat is then extracted from the water in order to have chilled water ready for the next milking. The extracted heat is transferred to another insulated tank of water, which is thereby heated ready for washing cows' udders, utensils, etc., 20 gal of hot water being available twice daily. The chilled water temperature is approximately 33 deg F, and the hot water temperature is 120–130 deg F. There is no extra running cost of producing hot water. A booster heater is, however, incorporated in the production models which automatically comes into operation at those times when the farmer is not milking up to capacity or if a temperature above 130 deg F is desired. The particular model illustrated has an open top and bucket feed, but in the production models the hot water tank will be pressurized and tapped to the farmer's existing wash trough, etc.

Toaster Griller

A new product of the ARORA COMPANY, Rosebery Street, Loughborough, comprises a ten-slice toaster griller complete with hot-cupboard. The interior metalwork and the top

Below: Loheat "Snowfire" cooler-heater
Right: Arora toaster griller





tray of the toaster griller are made of stainless steel, the remaining metalwork being finished in stoved enamel, aluminium colour, with black relief. Three-heat switch control is provided for the toaster griller with "Simmerstat" control for the hotcupboard (a.c. only). Hard rubber castors can be fitted if desired.

Combined Vacuum Cleaner and Polisher

The new "Com-Bo" machine made by the HENRAY ELECTRICAL CO., LTD., 18, Frith Street, Soho, London, W.1, can be changed over from vacuum-cleaning to floor-polishing, or vice-versa, by a simple movement of the handle. The double handle is designed to give greater control than the conventional type and requires the minimum of effort. The machine has a universal motor and is supplied in a range of colours. The price is 20 gns (plus P.T. in this country).

Variable-Speed Drives

The use of certain American patents, including the application of sensitive phase-shifting networks for the grid-control of mercury arc rectifiers used on variable-speed motor drives, has now been arranged by the Lancashire Dynamo & Crypto group of companies.

Prototypes of the new standard single-phase "Varionic" drive have already been built and tested by the NEVELIN ELECTRIC CO., LTD., at its Croydon works. The equipment provides an inexpensive variable-speed control incorporating feedback circuits for stabilization of speed, automatic current limitation and provision for automatically controlled dynamic braking when required; up to six pre-set speeds are available.

The whole unit is designed for maximum simplicity and reliability, and the standard equipment can be switched on load from cold without any preliminary warming up. The selection of components and materials has been made from items readily available in Great Britain so that no difficulty should arise if a replacement part is required. The drives are standardized for 200/500 V, single-phase supplies, for motors ranging from 1 to 3 h.p.

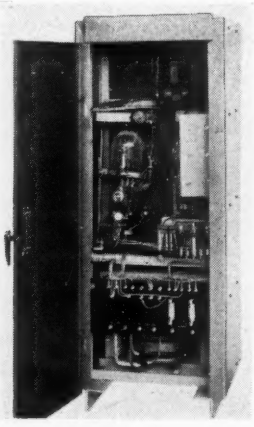
Wash-Boilers

An important feature of a new series of wash-boilers made by SOUTH WALES SWITCHGEAR, LTD., Blackwood, Mon, is that the inner and outer containers and the top casting are bolted together independently. Assembly is thus far more simple and the sealing is absolutely positive, while tests for water-tightness can be carried out at this stage of the construction.

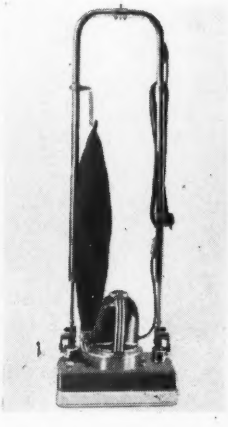
From the servicing point of view, the interior of the boiler can be taken to pieces, allowing the inner container to be changed and the re-sealing carried out *in situ* by unskilled labour. The outer casing has a swan neck swage, adding to the appearance of the boiler and also giving the outer casing additional strength. There is a spring clip at the back for attaching the cable when not in use.

Three models are available: model 510, galvanized (£7 19s); model 511, stove enamelled (£9 5s); model 512, stove enamelled with vitreous enamelled top cover (£10 4s). An a.c. type of cut-out can be supplied at an extra cost of £1 5s.

Nevelin "Varionic" standard single-phase variable-speed drive unit



Henray "Com-Bo" combined vacuum cleaner and polisher



South Wales Switchgear wash-boiler

ELECTRICITY SUPPLY

Street Lighting at Leamington

Electricity Output in 1950

AFTER the war the question of modernizing the street lighting at Leamington Spa was considered and both the local gas and electricity undertakings co-operated in experimental installations. Eventually fluorescent lighting was chosen as the most suitable medium and an installation was completed at the Parade the success of which led the Council to announce its intention of utilizing this form of lighting for all the main arteries within the borough.

The lighting scheme in the Parade consists of thirty-five "Mazda" fluorescent lanterns each housing three 80 W 5ft lamps. The units are mounted centrally at a height of 25ft on Stanton 6G columns, spaced at intervals of 100–120ft. An interesting feature is the use of tungsten lamps in the base of the columns behind armour glass, enabling the columns to act as illuminated signs separating the streams of traffic moving in opposite directions.

The next section to receive consideration was Warwick Street and Warwick New Road, from the Parade to the borough boundary at Portobello Bridge. This installation was recently switched on by the Mayor (Councillor B. A. Fetherston-Dilke) in the presence of representatives of the East Midlands Electricity Board and the manufacturers responsible. It consists of 46 Stanton reinforced concrete columns with G.E.C. lanterns, each containing two 80 W fluorescent tubes mounted horizontally on the same vertical plane and embodying perspex prisms for light control in place of the anodized aluminium reflectors. This is stated to be the first installation in this country using this type of lantern.

An inspection was also made of a demonstration installation erected by the G.E.C. in Regent Street comprising five group "B" Stanton reinforced concrete columns, two of 16ft and three of 14ft, each equipped with a vertical pole top perspex G.E.C. lantern containing four 40 W 2ft fluorescent lamps, pairs of lamps being operated in series.

"Mazda" fluorescent lighting at the Parade, Leamington

Generation in 1950

The kWh sent out for public supply during last year from generating stations controlled by the British Electricity Authority, the North of Scotland Hydro-Electric Board, and the Lochaber Power Co., increased by 12·2 per cent. as compared with an increase of 5·5 per cent

	Fuel consumed Thousand tons		kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Oil	Steam	Water Power	Total*		
British Electricity Authority ..	3,130	9·2	5,697	47	5,763	5,455	14,557
North of Scotland	25	1·7	33	103	142	141	528
Total for December, 1950	3,155	10·9	5,730	150	5,905	5,594	15,085
Corresponding total for December, 1949	2,910	6·5	4,868	151	5,040	4,766	13,913
Increase or decrease, per cent ..	+8·7	+67·7	+17·7	−0·7	+17·2	+17·4	+8·4
			(a)	(a)	(a)	(a)	
Total for 1950	31,794	73·9	53,307	1,478	55,014	51,958	
Total for 1949	28,908	53·5	47,740	1,174	49,115	46,324	
Increase or decrease, per cent ..	+10·0	+38·4	+11·7	+25·9	+12·0	+12·2	

* The total figure includes generation by oil engines amounting to 16·1 million kWh and waste heat plants, amounting to 8·3 million kWh, respectively, in December, 1950.

for 1949, while plant capacity rose by 8·4 per cent (against 5·2 per cent). The figures for December last and the totals for 1950 together with comparative figures for 1949 are shown in the accompanying table.

Electricity Output

For the week ended 5th January electricity sent out for public supply from solid fuel fired stations totalled 1,262·8 million kWh, as compared with 1,110·6 million kWh for the preceding week and 1,025·5 million kWh for the week ended 6th January, 1950.

Power Cuts in West Scotland

Days on which cuts in electric power are likely to be made in the West of Scotland are to be changed. The South-West Scotland Electricity Board states that this is being done because of the introduction of staggered hours in industry on Clydeside. Cuts in the Glasgow and Clyde electricity sub-areas will be on the same day each week as from next Monday. The "day of risk" will coincide with the short working day in the particular area. Consumers may determine their day of risk from the zone in which their premises are located, the zone designations being shown on the postcards which were recently sent to all consumers.

Proposed Extensions at Pinkston

Glasgow Corporation Municipal Transport Committee reports that negotiations are in hand with the Docks and Inland Waterways Executive, for the acquisition from them of land required for proposed developments at the Pinkston power station, particularly for the erection of cooling towers. The Committee has agreed to accept an offer by Metropolitan-Vickers Electrical Co., Ltd., for the supply and installation of one 30,000 kW turbo-alternator set at the Pinkston power station.

Street Lighting

The Scarborough Town Council has applied for sanction to borrow £12,000 for the lighting by electricity of Marine Drive and Royal Albert Drive, Scarborough. The Ministry of Health has offered no objection to the Council's proposal to spend £5,960 on electric street lighting on the Eastfield Estate.

Commercial Refrigeration

Since vesting day the sale, installation and maintenance of commercial refrigeration equipment has been carried on with success in the Fens, Norfolk and Suffolk Sub-Areas of the Eastern Electricity Board, and in consequence the Board has agreed to extend the activities to the whole Area. From the experience gained in the three Sub-Areas, and previously by the organization set up by the East Anglian Electric Supply Co., it is apparent that a good flow of business can be expected after three to six months from the commencement of full-scale selling efforts; furthermore, the best results are achieved from recommendations by existing users.

Proposed Glasgow Transport Improvements

TRAVELLERS of the future may be disembarked from buses and trains at traffic centres six or seven miles from Glasgow and then carried to the city by fast electric trains if recommendations by Lanark County Council to co-ordinate road and rail transport are accepted. The Council's recommendations, based on reports by the county surveyor, the chief constable, and the planning officer, have been transmitted to Sir Robert Inglis, chairman of the Clyde Valley Transport Committee, who has been instructed by the British Transport Commission to suggest methods of improving or developing transport facilities in the area.

The report suggests that a short-term plan with a reasonable prospect of early implementation may be preferable to a long-term policy unlikely to materialize for many years. By that time, with increasing congestion of road traffic, the diminishing popularity of local rail transport might have become irretrievable. Consideration might be given to the establishment of centres at focal points on the existing road-rail system at a radius of about six to seven miles from the centre of Glasgow. All road and rail passenger transport outside this radius could then be routed to converge on these centres and terminate there, other than long-distance traffic which would pass directly to the terminal railway stations within the city by change-over from steam to electric or diesel-electric traction.

Between these traffic centres and the terminal railway stations within the city a fast electrified rail service could be provided by utilizing the existing rail system, with frequent non-stop or limited-stop trains. In addition, an adequate local road transport service could be provided to originate and terminate at the traffic centres and routed through the suburbs and centre of the city in substitution for all existing local road transport services.

The report also favours the elimination of tramcars from main traffic routes, and points out that if the suggestions are adopted it would be necessary to institute an interchange of tickets between the two systems of transport. In which case there should be no difference in fares on similar journeys.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

The **Andhra Valley Power Supply, Ltd.,** reports a net profit for the year to 30th June last of Rs.25,61,432, as compared with Rs.1,17,073 for the preceding year. The final ordinary dividend is Rs.45 per share, tax free, making Rs.75 per share for the year. The balance carried forward is Rs.23,252 (against Rs.37,787 brought in).

The **Tata Hydro-Electric Power Supply, Ltd.,** reports a revenue for the year to 30th June last of Rs.50,84,215, as compared with Rs.50,74,002 for the preceding year, and a net profit of Rs.22,32,865 (against Rs.18,51,389). The final ordinary dividend is Rs.4-8-0 per share, tax free, making Rs.7-8-0 for the year, and Rs.35,948 is carried forward (against Rs.29,842 brought in).

The **Tata Power Co., Ltd.,** shows a revenue for the year ended 30th June last of Rs.1,19,76,306, as compared with Rs.1,17,22,338 for the previous year, and a net profit of Rs.48,31,905 (against Rs.40,83,648). It is proposed to pay a final ordinary dividend of Rs.50 per share, free of tax, making Rs.80 per share, and to carry forward Rs.14,455 (against Rs.2,01,701 brought in, including tax recovered).

Thorn Electrical Industries, Ltd., is to make an issue for cash and a scrip bonus distribution. The cash operation consists of 352,500 new 5s ordinary shares at a price of 15s 6d in the proportion of one for every two ordinary held. On that offer being completed, it is intended to issue by capitalization of share premiums 1,057,500 new ordinary shares on the basis of one for each ordinary share of the then issued ordinary capital.

Hilger & Watts, Ltd., report a net profit for the year to 30th September last of £35,373, as compared with £38,946 for the preceding year. The ordinary dividend for the year is unchanged at 7½ per cent.

Braithwaite & Co., Engineers, Ltd., have declared an unchanged interim dividend of 4 per cent.

New Companies

Wholesale Electro (Bradford), Ltd.—Registered 2nd January. Capital £10,000. Manufacturers, repairers and importers and exporters of and dealers in dynamos, motors, armatures, etc. Directors: H. Beevers, director of Wholesale Electro (Halifax), Ltd., etc., A. Buckley and E. Wilkes. Secretary: H. Beevers. Solicitors: Wilfred Dunn & Connell, Bradford.

Falkirk Electrical Winders, Ltd.—Registered in Edinburgh, 16th December. Capital £2,500. Electrical engineers and armature winders, etc. Directors: R. S. Laird and Mrs. Vera Laird. Regd. office: Falkirk Road, Labert.

Winnards, Ltd.—Registered 4th January. Capital £5,000. Electrical and mechanical engineering designers, manufacturers, importers and exporters of and wholesale and retail dealers in mechanical, electrical, motor and general engineering specialities and supplies, etc. Directors: S. H. Winnard, J. Weightman, Mrs. Ethel M. Winnard and Mrs. Lily Weightman. Regd. office: 77a, Back Station Road, Blackpool, S.S.

Stella Radio & Television Co., Ltd.—Registered 5th January. Capital £1,000. Directors: W. R. Tucker, E. W. Brades and R. J. Stevens. Address: Century House, Shaftesbury Avenue, W.C.2.

Geo. Watson (Electrical), Ltd.—Registered 5th January. Capital £5,000. Electrical, radio, mechanical and general engineers, etc. Directors: E. G. Watson (permanent) and Mrs. Enid G. Watson. Regd. office: 811, Green Lanes, N.21.

Cradley Transformers, Ltd.—Registered 5th January. Capital £5,000. Manufacturers, importers, exporters of and wholesale and retail dealers in electrical, motor, mechanical and non-mechanical vehicles, motor and engineers' spare parts, tools and components, machinery, etc. Directors: A. J. Crawley and W. A. Billingham. Regd. office: Endurance Works, Newtown Lane, Cradley Heath, Staffs.

Neon Maintenance (North London), Ltd.—Registered 8th January. Capital £1,000. Manufacturers and repairers of and wholesale and retail dealers in advertising and lighting signs, tubing, equipment, apparatus and supplies, etc. Directors: S. A. L. Gray and Alice G. Gray. Regd. office: 1, Frome Road, Wood Green, N.22.

N. Scarborough & Co., Ltd.—Registered 14th December. Capital £100. Mechanical and electrical engineers, etc. Directors:

N. C. F. Scarborough and Mrs. Elizabeth M. Scarborough. Regd. office: 95, Cornwall Street, Birmingham, 3.

Conductair (London), Ltd.—Registered 20th December. Capital £100. Mechanical, electrical and general engineers, etc. Directors: F. Devine, Joan Devine and J. W. Martin. Regd. office: Abford House, Wilton Road, S.W.1.

Haley, Mepham & Co., Ltd.—Registered 20th December. Capital £5,000. General and electrical engineers, etc. Directors: C. T. Haley, A. Bradley, V. H. Bradley, C. H. Mepham and F. C. Gale. Regd. office: 79, Davies Street, W.1.

Wilmas (Electrical), Ltd.—Registered 21st December. Capital £100. To acquire the business of electrical specialists formerly carried on by A. Lomas, E. Wilson and H. Varani as T. & A. Electrical Specialists at Holloway, N.19. Directors: Mrs. Elsie Lomas, Mrs. Mary Wilson, H. L. Varani (chairman) and Mrs. Ida Varani. Regd. office: 86, Eltherne Road, Holloway, N.19.

Increases of Capital

Yorkshire Electric Transformer Co., Ltd.—Increased by £60,000, in £1 ordinary shares, beyond the registered capital of £40,000.

Kent Bros. Electric Wire Co., & E. H. Phillips, Ltd.—Increased by £160,000, in £1 ordinary shares, beyond the registered capital of £40,000.

Phœnix Telephone & Electric Holdings, Ltd.—Increased by £411,595, in 211,695 5½ per cent cumulative first preference and 50,000 6 per cent cumulative redeemable second preference shares of £1 each and 599,600 ordinary shares of 5s each, beyond the registered capital of £100.

Wheeler Electrical Supplies (Wholesale), Ltd.—Increased by £5,000, in £1 ordinary shares, beyond the registered capital of £2,500.

Bankruptcies

J. Henderson, 17, Granville Terrace, Redcar, Yorks, lately residing and carrying on business at 82a, Galgate, Barnard Castle, Durham, as an electrician.—Receiving order made 4th January on debtor's own petition.

G. L. Barber, 19, St. Albans Street, Weymouth, Dorset, electrical contractor and radio engineer.—Trustee, Mr. C. Wild, 22, High East Street, Dorchester, released 13th December, 1950.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered within a month from the dates given.

3rd January

DIE STIMME SEINES HERRN (design). No. 690,546. Class 7. Washing, ironing, drying, wringing, dish washing, food mixing, food mincing, fanning, blowing and food grating machines, all being electrically operated; and parts of and fittings for all such goods, included in Class 7.—The Gramophone Co., Ltd., Blyth Road, Hayes, Middlesex.

STANEX. No. 687,160. Class 9. Switches, plugs, sockets, bell pushes and switch fuses, all being electrical goods.—J. A. Crabtree & Co., Ltd., Lincoln Road, Walsall.

DITOCALL. No. 689,312. Class 9. Audible and visible spark locating and calling apparatus, amplifiers, time recorders, burglar and fire alarms, loudspeakers, microphones, public address apparatus and telephone instruments and apparatus.—Dictograph Telephones, Ltd., Aurelia Road, Croydon.

AMAL. No. 691,831. Class 9. Electrical and scientific measuring and checking (supervision) apparatus and instruments included in Class 9.—Amal, Ltd., Holford Works, Perry Barr, Birmingham.

CATACON. No. 693,230, Class 9. Electrical condensers.—London Electrical Manufacturing Co., Ltd., 459, Fulham Road, London, S.W.10.

COMET. No. 668,281, Class 11. Electric lamp sockets or holders for use in converting oil burning lamps and lanterns into electric lamps and lanterns, etc.—R. E. Dietz Co., 60, Laight Street, New York. Address for service: c/o Stevens, Langner, Parry & Rollinson, 5–9, Quality Court, Chancery Lane, London, W.C.2.

S (design). No. B668,691, Class 14. Clocks (electric).—William Sanders & Co. (Wednesbury), Falcon Electrical Works, Ridding Lane, Wednesbury.

10th January

ARROW. No. 678,235. Class 9. Electric switches, plugs and sockets, and thermostats.—Arrow Electric Switches, Ltd., Hanger Lane, Ealing, London, W.5.

MICROPACK. No. 683,657, Class 9. Electrical condensers.—Telegraph Condenser Co., Ltd., Wales Farm Road, North Acton, London, W.3.

JACEX. No. 687,158, Class 9. Switches, plugs, sockets, bell pushes and switch fuses, all being electrical goods.—J. A. Crabtree & Co., Ltd., Lincoln Works, Lincoln Road, Walsall.

ELLIOTT (design). No. 690,595, Class 9. Electrical and mechanical measuring, testing, indicating, recording and control instruments and apparatus; temperature measuring apparatus, electrical resistance thermometers, temperature indicators and recorders, humidity measuring and recording apparatus, gas analysing and recording instruments and apparatus, pressure gauges; level indicators and alarms, boiler control apparatus; transmission systems for remote indication integration, recording and control of power, liquid and gas pressures; telegraph instruments and apparatus; and wind speed measuring and indicating instruments and apparatus.—Elliott Brothers (London), Ltd., Century Works, Lewisham, London, S.E.13.

ELREMCO (design). No. 692,311, Class 9. Electrical apparatus and instruments included in Class 9 and scientific apparatus and instruments.—Electrical Remote Control Co., Ltd., 15, Evanston Avenue, Highams Park, London, E.4.

VIDOR. No. 693,158, Class 9. Wireless, television and telegraphic instruments and apparatus, gramophones, and parts included in Class 9 of all such goods; batteries; and cases for electric torches or pocket lamps.—Vidor, Ltd., West Street, Erith, Kent.

VICTROL. No. 691,967. Class 17. Electrical insulating oils.—Newton Victor, Ltd., 15–19, Cavendish Place, London, W.1.

STOCKS and SHARES

PRICES of industrial shares—as measured by the popular indices—have started the year with a lively assault on the peaks traced on the graph during 1950. Both this buoyancy and the volume of business have taken many dealers by surprise. Contributory factors evidently include a disposition to hold good ordinary shares in preference to cash, in circumstances which are steadily eroding the latter's value. In addition, world rearmament policies are taken to assure the fullest practicable employment of labour and resources at home, and boom conditions in the commodity-producing areas overseas. Dividend expectations, and reinvestment action in advance of the Steel Bill, have further helped to keep in the background the anxiety about politics, raw materials and the Budget. Discrimination favours the capital and "high priority" industries. The market in electrical engineering issues received its full share of attention from these various points of view.

Dividend Expectations

One of the weightiest factors behind this month's advance of industrial share prices is, without doubt, the accumulating evidence that moderation has replaced limitation as the guiding principle in company dividend policies. Some recent interim announcements, notably that of Shell Transport, have spurred imagination in connection with the main dividend season for 1950, due to open in the next month or so. People are not expecting anything even verging on the spectacular. Taxation and demands on working capital at the present level of prices, will no doubt do all that is necessary to impose restraint. There will, nevertheless, be disappointment in the electrical engineering (and other) markets if a partial thaw fails to loosen the frozen dividend policy. Among the first in the dividend field, as a rule, is English Electric, which paid 10 per cent last time from earnings of over 40 per cent.

Ekco

After rising since the beginning of this month from 18s to 20s 9d, the 5s shares of E. K. Cole stand at the best price recorded for more than two years, during which they have been down to half-a-guinea. Attention has lately been drawn to the wide extent over which the company's ramifications extend beyond the central business in radio and television. Apart from the company's electric lamp interests, it seems to be the plastics division which has accounted for some of the recent buying of the shares. Plastics issues in general have enjoyed a revival of investment popularity on the strength of their "substitute" possibilities in this phase of raw material shortages. The company put itself in funds last October with a £400,000 loan issue. There was ample cover for the last dividend of 20 per cent, on which basis the shares pay just under 5 per cent on the money.

Price Changes on the Week

Telegraph Constructions are a good market, with a gain of 2s 6d at 50s. Mather & Platt, 41s 9d are 1s 9d up, and Ever Ready, 29s, have risen 1s 6d. Tube Investments 6¼, Telephone Properties 25s, Joseph Lucas 35s, Greenwood & Batley 48s 9d are all 1s 3d higher. Other advances include General Electric 83s 9d, Burco 24s 6d, International Combustion 16s 6d, Laurence Scott 13s 3d, Murex 51s. International "Tel. & Tel." at 31½ have put on 3½ points. On the other hand, British Electric Traction deferred is 10 lower at 515. Calcutta Trams shed 2s 6d to 30s. Revo 43s 3d, Cossor 11s 6d and "Emi" at a guinea are lower since a week ago. Tokyo Electric 6 per cents—the last coupon paid was in June, 1941—have risen to 66½, being 4 up on the week.

Tube Investments Preference

Stockholders of Tube Investments showed a ready appreciation of the terms on which they were offered the five million new 4½ per cent preference shares. The price of £1 per share attracted heavy over-subscription. Smaller applications were satisfied in full, but allotments were reduced to 25 per cent of applications for over 3,000 shares. Dealings are in progress at 1s premium making the yield basis just over 4½ per cent. Since the shares will be transferable free of stamp while in allotment letter form, they still compare well with others of the same distinguished calibre, several of which pay the buyer less than 4 per cent, after expenses, on the money. Another electrical issue is expected before long in the shape of an offer of debentures by Enfield Cables.

Bonus Considerations

Strength in the price of Hoovers 5s shares, following the declaration of a one-for-one share bonus, attracts notice to the present market disposition to welcome (rightly or wrongly) such issues as a possible precursor of some relaxation in dividend policies. Experience has lately done a good deal to encourage that point of view. Joseph Lucas trebled the nominal capital last year by a free share bonus, and subsequently reduced the dividend rate by rather less than the appropriate one-third. British Electric Traction dealt similarly with its capital and has since reduced the rate of distribution by one half. Earlier, Allen West maintained the dividend-rate after a 60 per cent capital increase. The market hopes to see similar action by Ericsson Telephones, following the one-for-eight share distribution of last month.

NEXT WEEK'S EVENTS

Monday, 22nd January

BIRMINGHAM.—James Watt Institute, 6 p.m. I.E.E. South Midland Centre. "Some Notes on Electrical Installations in Large Chemical Factories," by D. B. Hogg.

BRISTOL.—Electricity House, Colston Avenue 6 p.m. I.E.E. Western Utilization Group. Lecture on "Evolution of the Lighting Art," by Dr. J. W. T Walsh.

LEEDS.—Central Y.M.C.A. Buildings, Albion Street, 7.15 p.m. A.S.E.E. Leeds Branch. "Heating and Ventilating of Factories and Public Buildings," by L. C. Watts

LIVERPOOL.—Royal Institution, Colquitt Street 6.30 p.m. I.E.E. Mersey and North Wales Centre "The Control of Hydro-Electric Plant," by A. C. H Frost and W. Brittlebank.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Radio Section. Discussion on "How Reliable is a Radio Valve?" opened by Dr. G. H. Metson.

READING.—Great Western Hotel, 7 p.m. I.E.E. District Meeting. "Trends of Development in Radiocommunication," by Prof. Willis Jackson.

Tuesday, 23rd January

GLASGOW.—At the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, 7 p.m. I.E.E. Scottish Centre. "The Performance of the British Grid Systems in Thunderstorms," by Dr. J. S. Forrest.

LEEDS.—Lighting Service Bureau, 24, Aire Street, 6.30 p.m. I.E.E. North Midland Utilization Group. "Some Notes on Electrical Installations in Large Chemical Factories," by D. B. Hogg.

LOUGHBOROUGH.—The College, 6.30 p.m. I.E.E. East Midland Centre. "Design of Power Transformers to withstand Surges due to Lightning, with special reference to a New Type of Winding," by A. T. Chadwick, J. M. Ferguson, D. H. Ryder and G. F. Stearn.

Wednesday, 24th January

BRIGHTON.—Technical College, 6.30 p.m. I.E.E. Southern Centre. "The Design and Operation of a 30-MeV Synchrotron," by D. W. Fry, J. Dain H. H. H. Watson and H. E. Payne.

COVENTRY.—Coventry Technical College, 7.15 p.m. A.S.E.E. Coventry Branch. "Electrical Accidents," by H. Midgley.

LANCASTER.—N. W. E. B. Demonstration Theatre, North Road, 7 p.m. I.E.E. North Lancashire Sub-Centre. "Some Operating Experiences with High-Pressure Steam Power Plant," by W. N. C. Clinch.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply Section. "The Planning of an Electricity Board's Distribution System," by G. O. McLean.

Waterloo Bridge House, S.W.1, 5 p.m. Institution of Post Office Electrical Engineers. Informal meeting. "Engineering Service," by C. Feather.

Waldorf Hotel, W.C.2, 6.45 p.m. Institution of Works Managers. "What is this Production Control?" by H. F. Webb.

MANCHESTER.—Engineers' Club. Albert Square, 6.30 p.m. I.E.E. North-Western Radio Group. "The Use of Saturable Reactors as Discharge Devices for Pulse Generators," by W. S. Melville.

RUGBY.—The Temple Speech Room. I.E.E. Rugby Sub-Centre. Faraday Lecture. "Lamps and Lighting—a record of Industrial Research," by L. J. Davies.

Thursday, 25th January

BRADFORD.—Y.E.B. Offices, 45–53, Sunbridge Road, 7.30 p.m. I.E.S. Bradford Group. "Light, Colour and the Stage," by E. Faraday.

LUTON.—George Hotel, 8 p.m. A.S.E.E. Luton Branch. "Light, Vision and Lighting," by B. H. Gurr.

NOTTINGHAM.—Gas Showrooms, Parliament Street, 5.30 p.m. I.E.S. Nottingham Centre. "Textile Lighting," by T. S. Jones.

RUGBY.—E.M.E.B. Little Church Street, 6.30 p.m. I.E.E. Rugby Students' Section. "The Control of Gas Turbines," by E. H. Warne. (Joint meeting with Midland Graduates Section, I.Mech.E.).

Friday, 26th January

LONDON.—Caxton Hall, S.W.1, 7 for 7.30 p.m. Junior Institution of Engineers. Annual dance.

17, Victoria Street, S.W.1, 6.30 p.m. Society of Engineers. Informal meeting. Address by the new chairman, Mr. J. C. Maxwell Cook.

NEWCASTLE-ON-TYNE.—Mining Institute, 6.15 p.m. North East Coast Institution of Engineers and Shipbuilders. "Electronics in Naval Architecture," by Prof. L. C. Burrill.

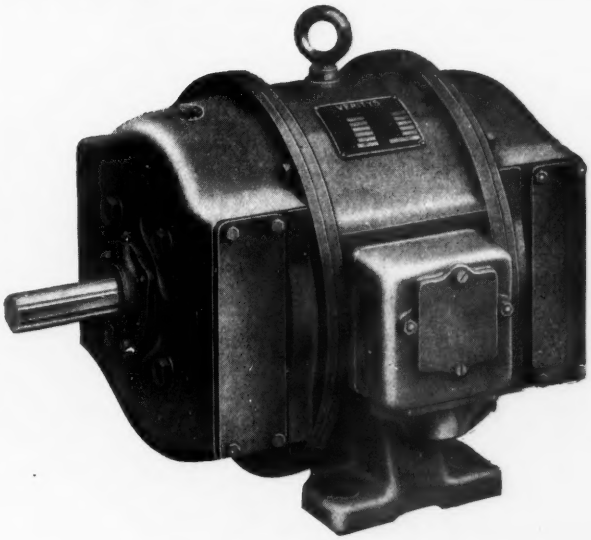
Saturday, 27th January

LEEDS.—College of Technology, Cookridge Street, 10 a.m. I.E.E. North Midland Education Discussion Circle. Discussion on "The M.K.S. System," opened by A. H. Greenwood.

The Blind in Industry

THE Working Party appointed by the Minister of Labour and National Service to investigate the facilities existing for employment of blind persons in industry has now issued its report (H.M. Stationery Office, 1s 9d net). This contains recommendations for improvements in the existing methods of helping the blind to help themselves; e.g., by the expansion of facilities for their training, by intensive specialized services for placing them in occupations open to them; and by the breaking down of any prejudices that may still remain against their employment in "open" industry, as distinct from employment in "sheltered" special workshops for the blind. Reference is made to the manifold activities of the National Institute for the Blind on behalf of the civilian blind, and of St. Dunstan's on behalf of the war-blinded.

MOTORS



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NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1945

25021. British Thomson-Houston Co., Ltd. (General Electric Co.).—Electric follow-up control systems. 26th September, 1945. (650022.)

1947

65. Murphy Radio, Ltd., and Fairhurst, H. A.—Scanning in television receivers. 12th May, 1949. (650026.)

7725. Standard Telephones & Cables, Ltd., and Reeves, A. H.—Electric signal storage or demodulating circuits. 10th March, 1948. (650032.)

16991. Aircraft-Marine Products, Inc.—Electrical connectors. 27th June, 1947. (650096.)

18988. British Thomson-Houston Co., Ltd.—Radio beating equipments. 16th July, 1947. (650038.)

20183. Akt.-Ges Brown, Boveri & Cie.—Arc extinguishing horns, and chambers for electric switches. 29th July, 1947. (650039.)

22024. Communications Patents, Ltd., Baring, S., and Wilson, L. F.—Distribution of telephonic signals. 26th August, 1948. (650098.)

23080. Philips Electrical, Ltd.—Manufacture of semi-conductive material. 20th August, 1947. (650099.)

24745. Philco Corporation.—Cathode-ray tubes. 9th September, 1947. (650044.)

27041. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.—Colour television systems and apparatus. 8th October, 1947. (650104.)

27084. Philips Electrical, Ltd.—Electric discharge tubes. 8th October, 1947. (650045.)

28760. Metropolitan-Vickers Electrical Co., Ltd., and Scoles, G. J.—Aerial systems. 6th September, 1948. (650047.)

29624. Radio Corporation of America.—Simultaneous colour television. 6th November, 1947. (650106.)

30945. British Thomson-Houston Co., Ltd.—Starting circuits for electric discharge lamps. 21st November, 1947. (650108.)

32597. General Electric Co., Ltd., and Caldwell, J. T.—X-ray apparatus. 29th November, 1948. (650049.)

33742. Gretener, E.—Direct current arc lamp. 20th December, 1947. (650112.)

34245. Guanella, G.—Distance measuring devices utilizing reflected wave energy. 24th December, 1947. (650114.)

34578. Rund, I. O.—Electromagnetic driving system. 30th December, 1947. (650052.)

1948

89. Soc. Française Radio-Electrique.—Radio transmitting systems. 1st January, 1948. (650055.)

3085. Ekco-Ensign Electric, Ltd., and Stickley, W. A.—Arrangements for operating electric discharge lamps. 3rd February, 1949. (650168.)

6757. Soc. Anon. Française du Ferodo.—Electromagnetically-operated friction clutch. 4th March, 1948. (650174.)

10638. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Circuit arrangements comprising at least one switch for the control of at least one conductive lead. 16th April, 1948. (650146.)

10858. Westinghouse Electric International Co.—X-ray apparatus. 20th April, 1948. (650179.)

13830. Resistance Welders, Ltd., Gordon, S. H., and Thomson, C.—Work-clamping arrangements of electric resistance welding and heating machines. 20th May, 1949. (650125.)

14019. General Electric Co., Ltd., and Baker, W. F.—Electric inductor constructions for use in high-frequency electric induction heating. 12th May, 1949. (650184.)

14141. General Electric Co., Ltd., and Friedlander, E. S.—Electric welding systems. 4th May, 1949. (650185.)

16083. Philips Electrical, Ltd.—Cooling devices for electric discharge tubes. 15th June, 1948. (650130.)

17326. Modern Telephones Co., Ltd., Marks, L. V., and Briscomb, D. W.—Intercommunication telephone systems. 28th June, 1949. (650070.)

17791. Marconi's Wireless Telegraph Co., Ltd., and Dunsford, J. E.—Concentric cables and feeders for use on high frequencies. 8th March, 1949. (650075.)

20021. British Thomson-Houston Co., Ltd.—Liquid immersed electrical apparatus. 27th July, 1948. (650086.)

20735. Thompson, A. W., and Howe, J. H.—Impregnants for cables or condensers. 30th November, 1948. (650088.)

21035. Dutilh, J. R. H.—Electromechanical phase-shifter. 10th August, 1948. (650137.)

21910. Huddleston, F. B.—Containers for packaging electric lamps and similar articles. 19th August, 1948. (650140.)

22266. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Voltage multipliers. 24th August, 1948. (650142.)

22346. Standard Telephones & Cables, Ltd., and Gibson, W. T.—Electric resistance devices. 25th August, 1948. (650143.)

24642. Tyson, W. M.—Electric liquid heaters. 20th September, 1949. (650197.)

30981. Shipton & Co., Ltd., E., and Joseph, R. J.—Polarized relays. 29th November, 1949. (650207.)

31897. British Celanese, Ltd.—Photo-electric stop-motions for warp knitting and like machines. 9th December, 1948. (650210.)

32309. Westinghouse Electric International Co.—Refrigeration apparatus. 14th December, 1948. (650211.)

33430. Gallois, R.—Electrical process for melting glass. 29th December, 1948. (650219.)

33613. Western Electric Co., Inc. Multicontact relays. 31st December, 1948. (650220.)

Amended Specifications

577092. Edmundsons Electricity Corporation, Ltd., & ors.—Electric cut-out or protective apparatus suitable for polyphase circuits.

600792. Soudure Electrique Autogene, Soc. Anon.—Oxy-electric cutting.

625531. Western Electric Co., Inc.—Method of and apparatus for assembling insulating rings on a central core.

631102. Telegraph Condenser Co., Ltd., & anr.—Electric terminals and bushes.

633195. Landis & Gyr Soc. Anon.—Electric selector switches or receiving devices for remote-control installations.

639040. British Insulated Callender's Cables, Ltd., & ors.—Electric conductors for high voltage overhead lines.

ELECTRICAL IMPORTS OF CEYLON

CEYLON'S electrical imports in 1949, in their main groups, are shown in the accompanying table which is based on that country's official trade returns. Increases or decreases compared with 1948 are added for purpose of comparison. It will be seen that a big advance took place in motors, switchgear and unspecified electrical machinery. Imports of generating plant showed a decline, after a large increase between 1947 and 1948.

Class of Goods	1949 Rs.(000)	Inc. or dec. on 1948 Rs.(000)	Class of Goods	1949 Rs.(000)	Inc. or dec on 1948 Rs.(000)
Control and switchgear	3,180*	+ 2,774	Radio instruments and apparatus	1,467	+ 267
Transformers and convertors	159	— 42	*From United Kingdom*	1,241	+ 114
Generators and alternators and exciters	706	— 821	„ *United States*	61	+ 15
From United Kingdom	351	+ 103	„ *Holland*	130	+ 114
„ *United States*	355	— 924	Other telegraph and telephone instruments	1,190	+ 483
Motors	541	+ 343	Lighting accessories, fittings and switches	2,595	— 138
From United Kingdom	509	+ 325	*From United Kingdom*	1,405	— 192
Elec. machinery not elsewhere specified	995	+ 439	„ *United States*	106	+ 75
From United Kingdom	831	+ 395	„ *Hong Kong*	982	— 69
„ *United States*	68	+ 39	„ *Japan*	54	+ 54
Rubber insulated wires and cables	926*	+ 24	Batteries, dry, radio	22*	+ 2
Other electric wires and cables	1,302	+ 66	Ditto, other than radio	2,298	+ 58
Lamp bulbs, gas filled	440	+ 2	*From United Kingdom*	116	— 510
From United Kingdom	427	—	„ *Malaya*	1,862	+ 1,301
„ *Holland*	6	— 4	Other batteries and accumulators	50	— 130
„ *Japan*	3	+ 3	Electrical goods and apparatus not elsewhere specified	1,452	+ 201
Other lamp bulbs	152	— 1	*From United Kingdom*	1,242	+ 51
From United Kingdom	138	— 12	„ *United States*	89	+ 36
„ *Japan*	11	+ 10	„ *Japan*	10	+ 10
Torch bulbs	279	+ 76	„ *Germany*	1	+ 1
From United Kingdom	115	+ 78			
„ *Hong Kong*	89	— 28			
„ *United States*	61	+ 13			

* Mainly from U.K.

IMPORTS OF KENYA AND UGANDA

ELECTRICAL imports into Kenya and Uganda continued to expand in 1949, big increases taking place in power plant, wires and cables, telegraph and telephone apparatus lighting fixtures and miscellaneous appliances The only decrease of note was in radio goods.

Class of Goods	1949 £(000)	Inc. or dec. on 1948 £(000)	Class of Goods	1949 £(000)	Inc. or dec. on 1948 £(000)
Generators, motors, convertors and transformers	462	+ 297	Ditto, other, and spares	28	— 7
From United Kingdom	398*	+ 250	*From United Kingdom*	17	— 11
Batteries and accumulators for motor vehicles	94	— 19	„ *Holland*	3	— 1
From United Kingdom	82	— 26	Telegraph and telephone instruments and apparatus	169*	+ 79
„ *Australia*	4	+ 2	Insulated cables and wire	450	+ 226
Lamp and torch batteries	58	+ 23	*From United Kingdom*	361	+ 168
From United Kingdom	2	— 3	„ *South Africa*	21	— 2
„ *South Africa*	21	— 7	„ *Australia*	4	— 1
„ *Malaya*	33	†	Portable tools and appliances and small household elec. devices	46*	+ 5
Other batteries and accumulators	10	+ 4	Elec. appliances for motor vehicles, cycles and i.c. engines	48	+ 18
From United Kingdom	4	—	*From United Kingdom*	33	+ 15
Bulbs and tubes for lighting, domestic	32	— 17	„ *Australia*	3	—
From United Kingdom	14	— 21	„ *United States*	8	+ 2
„ *Holland*	15	+ 1	Torches, complete or exclu. batteries and bulbs	43	— 2
Ditto for torches and handlamps	10	+ 3	*From United Kingdom*	2	— 9
From United Kingdom	6	+ 3	„ *Hong Kong*	40	+ 7
„ *Hong Kong*	1	— 2	Lighting fixtures	331	+ 158
„ *South Africa*	1	+ 1	*From United Kingdom*	285	+ 119
Radio receiving sets, domestic	115	— 35	„ *South Africa*	4	+ 1
From United Kingdom	70	— 39	Other appliances and apparatus	213	+ 47
„ *Holland*	40	+ 7			

* Mainly from U.K. † Comparative figures not available.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section, the date of the issue is given in parentheses.

Australia.—BRISBANE.—8th February. City Electric Light Co. Three 10,000 kVA on load, tap changing transformers. (C.R.E. (I.B.) 50579/51. Ten/2037.)* 8th March. 240 V station battery and a trickle battery charger. (C.R.E. (I.B.) 50615/51. Ten/2039.)*

Belgium.—BRUSSELS.—24th January. Belgian State Railways. Electro-mechanical signalling equipment. (C.R.E. (I.B.) 50297/51. Ten/2027.)*

Bingley.—2nd February. U.D.C. Installation of trunk road lighting. (See this issue.)

Carlisle.—Education Committee. Electrical installation at the Belah Junior and Infants' School. City engineer, 18, Fisher Street.

Egypt.—CAIRO.—29th January. Municipalities Department, Ministry of Municipal & Rural Affairs. Diesel electric generating sets for power stations at Fakous, Simbellamein, Fashu, Abu Tig and Kafr el Sheikh. (C.R.E. (I.B.) 58301/50. Ten/2020.)*

El Salvador.—23rd February. Executive Hydro-Electric Commission for River Lempa. Aluminium cables for h.v. lines from Guayabo plant to San Salvador and San Miguel. (C.R.E. (I.B.) 50601/51. Ten/2034.)*

Heston.—2nd February. Southern Electricity Board, No. 1 (Southall) Sub-Area. Changeover of wireless equipment. (See this issue.)

London.—28th February. Metropolitan Water Board. 11 kV and 415 V switchgear and motor control desks and six transformers for Chingford South pumping station. (See this issue.)

SOUTHWARK.—31st January. Borough Council. Lamps. Town clerk, Town Hall, Walworth Road, S.E.17.

Montgomeryshire.—30th January. County Council. Re-wiring and extending the electrical installation at Llwyn Hall, Llanfyllin. County architect, County Offices, Newtown, Mont.

New Zealand.—WELLINGTON.—24th January. Wellington Harbour Board. Switchgear and lighting fittings for Store 51. (C.R.E. (I.B.) 74291/50. Ten/2014.)*

INVERCARGILL.—23rd February. Corporation. Distribution transformers (C.R.E. (I.B.) 50037/51. Ten/2016.)*

Prestwich.—3rd February. Borough Council. Lamps and electrical equipment. Borough engineer, Town Hall.

Swinton and Pendlebury.—3rd February. Town Council. Wiring and fittings for 100 houses, Clifton estate. (See this issue.)

Thailand.—BANGKOK.—19th February. Stores Division, Railway Department. Supply of five overhead cranes. (C.R.E. (I.B.) 50270/51. Ten/2030.)*

United States.—NEW YORK.—29th January. United Nations, Lake Success. Automatic private telephone exchange. (C.R.E. (I.B.) 73186/50. Ten/2025.)*

Uruguay. — MONTEVIDEO. — 20th February. Administracion General de las Usinas Electricas y los Telefonos del Estado. Supply of black insulating tape. (C.R.E. (I.B.) 74263/50. Ten/2031.)*

Westminster.—5th February. City Council. Lamps, cable, etc. Town clerk, City Hall, Charing Cross Road, W.C.2.

Worsborough.—26th February. U.D.C. Street lighting equipment. (See this issue.)

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, S.W.1 (Victoria 9040).

ORDERS PLACED

Durham.—County Education Committee. Electrical installation at the Annfield Plain County Infants' School (£335).—R. Keeler (Chester-le-Street). Electrical installation at the Jarrow Simonside New County School (£2,795).—Gray Brothers (Newcastle), Ltd.

London.—L.C.C. Electrical installation at Richie Secondary School, N.1.—Rae Electric (London), Ltd. Electrical installation at Oldfield Road School, Stoke Newington.—Thorpe & Thorpe, Ltd.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ashington.—Drill hall; J. & W. Lowry, builders, Corporation Street, Newcastle-on-Tyne.

Bassingbourn.—Secondary modern school (£86,940), for Herts E.C.; county architect, Hertford.

Blackburn.—Witton Park County Secondary School for Girls (£140,400); borough engineer.

Bootle.—Technical and Grammar School adjoining Dunnings Bridge Road; surveyor.

Bradford.—Reception block at Springfield, Squire Lane (£19,765) for T.C.; L. & W. Morrell, Ltd., Low Moor.
Municipal hostel (500 places), for T.C.; W. H. Leathem, town clerk.

Brighton.—New Foundry shop; Dentsply, Ltd., Coombe Road.

Burnley.—High school for girls, Ivy Bank; C. V. Thornley, town clerk.

Cheltenham.—Houses (100), Arle and Hester Way estate, for T.C.; borough surveyor.
Works extensions, Gloucester Place; Haines & Strange, motor engineers, 99, High Street.

Cheshire.—Houses (500) in various districts; county architect.

Chester-le-Street.—Primary school, Barley Mow estate for Durham C.C.; county architect, Court Lane, Durham.

Colwyn Bay.—Extensions to pier and erection of an entertainments hall (£125,000); borough engineer.

Coryton.—Oil refinery for Vacuum Oil Co., Ltd., Caxton House, London, S.W.1.; John Laing & Son, Ltd., contractors, Bunns Lane, London, N.W.7.

Coventry.—Departmental stores and offices (£350,000); F. W. Woolworth & Co., Ltd., Dudley Street, Birmingham, 5.
Dwellings (108), Sadler Road, for T.C.; city architect.

Denbighshire.—Engineering and plumbing workshops at Barberry Hill, Colwyn Bay, and arts and crafts block at Teachers' Training College, Wrexham; W. E. Bufton, clerk, County Offices, Ruthin.

Doncaster.—Works extensions; Geo. Moxon (Mining), Ltd., Wheatley Hall Road.

Dundee.—Factory and offices; British Oxygen Co., Ltd., Bridgewater House, London, S.W.1.

Enfield.—Warehouse, Gordon Hill; Enfield Highway Co-operative Society, Ltd., 112, Ordnance Road.
Factory extensions and new laboratory; Ferguson Radio Corporation, Ltd., Great Cambridge Road.

Finchley.—Flats (124) for T.C.; J. R. Southcombe, architect, The Avenue, London, N.3.

Gosforth.—Houses (96) in Church Road and Church Avenue area for the U.D.C.; C. Wyld, surveyor.
Houses (18); surveyor, U.D.C. offices.

Hebburn-on-Tyne.—Houses (30) at Mill Lane for the U.D.C.; J. M. Black, Ltd., builders, Glen Street.

Hemel Hempstead.—Factory; Alford and Alder, motor engineers, Walworth Road, S.E.17.

Hindley.—Houses (32) at Castle Hill estate for U.D.C.; J. Gaffney & Sons, Whelley, Wigan.

Huddersfield.—New general hospital, for Leeds Regional Hospital Board; W. A. Shee, secretary, 29/31, Eastgate, Leeds, 2

Hull.—Houses (102), Bilton Grange extensions, for T.C.; city architect.

Inverness.—Primary school, Shelibost Harris, and secondary school, Daliburgh, North Uist, for County E.C.; county architect, The Castle.

Kettering.—Three-storey technical institute for Northants E.C.; county architect, County Hall, Northampton.

Lancashire.—Technical colleges at Accrington, Ashton-under-Lyne and Lancaster, for C.C.; G. Noel Hill, county architect, County Offices, Preston.

Leigh.—New outpatients' and casualty department at Infirmary; Bradshaw, Gass and Hope, architects, Bolton.

Loughborough.—Houses (24) at Garendon Road, for T.C.; W. A. Soar, Cobden Street.

Macclesfield.—Primary school, Broke Cross; H. Rochford, Ltd., Gawsworth Cross, Macclesfield.

Newton Aycliffe (Co. Durham).—Houses for the Aycliffe Development Corporation. Builders: Porteous & Son, Darlington (11 houses); Blackett & Son, Darlington (60); and E. Lawson, Ltd., Darlington (19).

Saltney.—Works extensions; The Rustproof Metal Window Co., Ltd.

Shiremoor.—School for Northumberland E.C.; H. E. Pitt, Ltd., Leopold Street, Millfield, Sunderland.

Southport.—Factory extensions; W. Karn & Sons, Ltd., Compton Road.

Stoke-on-Trent.—Offices, Hill Street, for Ministry of Food; Geo. A. Poole, builder, 37, Liverpool Road, Newcastle-under-Lyme.

Todmorden.—Houses (48), Harley Wood, for T.C.; borough surveyor.

Tynemouth.—Civil Defence Headquarters (£4,000); borough engineer.

Wellingborough.—New church of St. Barnabas; Talbot Brown, Panter and Partners, architects.

West Bromwich.—Factory and offices, Birmingham Road; J. Brockhouse & Co., Ltd., spring and axle manufacturers, Hill Top.

Weston-super-Mare.—Flats (60), Summerlands estate, for T.C.; borough surveyor.

Weymouth.—Houses (134), Downclose estate, for T.C.; borough surveyor, 6, Pulteney Buildings.

Widnes.—Houses (96), Crow Wood site (£104,812), for T.C., by direct labour; F. Meflor, borough architect, Brendan House, Widnes Road.

British Book and Periodical Exhibition

A BRITISH Council exhibition of scientific and technical books and periodicals opened in Vienna on January 15th. The exhibition contains 1,300 books and nearly 400 periodicals and is divided into sections on medicine, including nursing; pure sciences, including chemistry; and applied sciences, including agriculture, building, engineering, metals, manufactures and industrial organization.